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The Journal of HEREDITY

A monthly publication devoted to Plant Breeding Animal Breeding and Eugenics

FEBRUARY, 1920

Vol. XI, No. 2

THE WATER BUFFALO

PISTILLATE FLOWERED MAIZE PLANTS

EUGENICS AND OTHER SCIENCES

APPLIED EUGENICS

CONTINUOUS VARIATION IN COLOR

DEVELOPMENT OF USEFUL CITIZENSHIP

A MUTATING BLACKBERRY-DEWBERRY HYBRID

AN AWARD OF HONOR

ORGAN OF THE

AMERICAN GENETIC ASSOCIATION

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The Journal of Heredity

(Formerly the American Breeders' Magazine)

Vol. XI, No. 2 February, 1920

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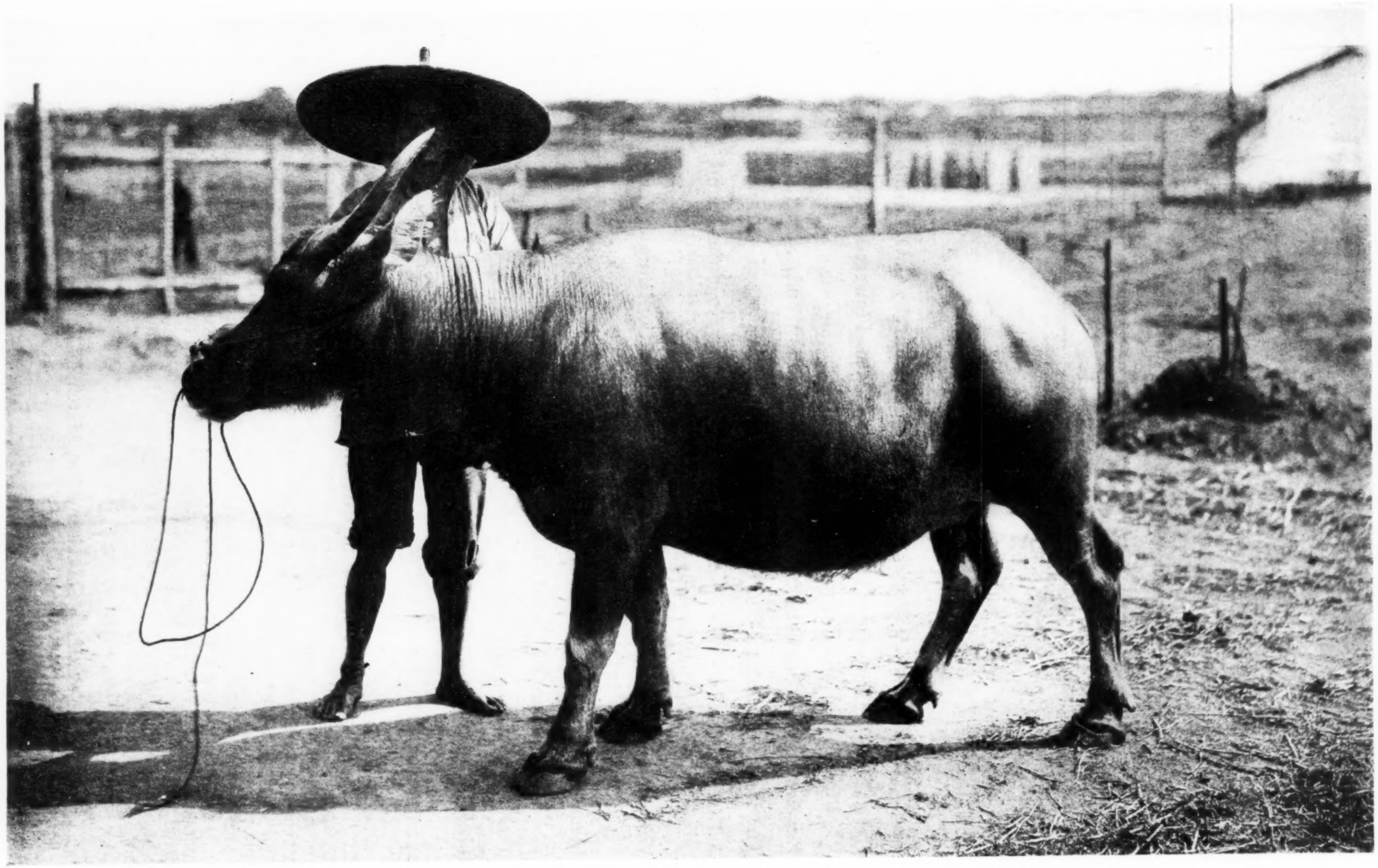


A WATER BUFFALO COW FROM THE DAIRY HERD AT CANTON CHRISTIAN COLLEGE

The water buffalo is common in all parts of southern China, where its principal use has been as a draught animal in the rice fields. In recent years, however, its importance for dairy purposes has come to be realized. When the animals are no longer useful for work or dairy needs, they are slaughtered for beef. There are favorable possibilities of the water buffalo for dairy purposes in southern United States. (Frontispiece.)

THE WATER BUFFALO—A TROPICAL SOURCE OF BUTTER FAT

C. O. LEVINE

Associate Professor of Animal Husbandry, Canton Christian College

THE water buffalo (*Bubalus bubalis*) is found in all parts of China as far north as Shanghai. It is most common in regions where lowland rice is the main crop grown by the farmers, where it finds its chief use as a draught animal in the wet paddy fields. The estimated common weight of the water buffalo in China is about 800 to 1,200 pounds. Measurements, made by the writer, of twelve cows kept on the college farm have given an average height of 49 inches at the withers.

Like the pig, the water buffalo has few sweat glands in its skin, and for this reason cannot endure hard work in the sun for a long period, unless its body is wet with water. This accounts for the desire of the buffalo to wallow in mud or water. The animals are easily overcome by heat if worked hard in the sun, and sometimes they go crazy and become very dangerous. Not infrequently such an animal has to be killed.

However, animals kept only for milk production, and not required for any work do not necessarily require a water hole for comfort. This is especially true of the dairy breeds of buffalo of India.

As a rule, the water buffalo is a gentle animal—toward Orientals. Europeans usually find this animal difficult to manage, and all attempts by Europeans to raise the buffalo have failed, except in Italy and some other places in southern Europe, where it has been raised for centuries. The dairy water buffalo of northern India, however, although of immense size and fierce looks, is very gentle and can be handled by Europeans as well as by natives of that region.

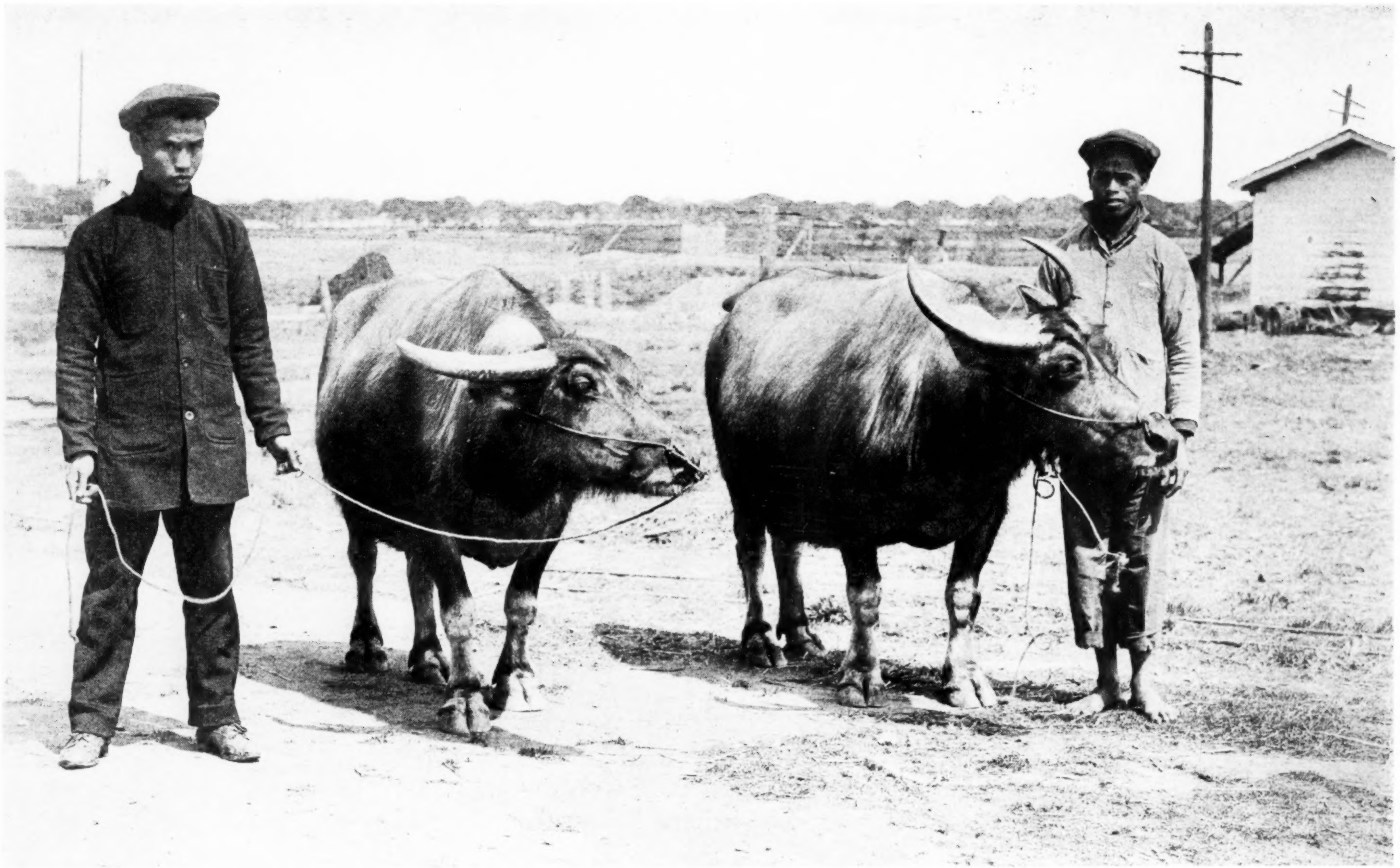
The horns of the Chinese buffalo are peculiar in shape. They are large and much flattened, or somewhat triangular at the base, deeply grooved on the upper surface, directed out and back from the head and finally curving inward. The length, measured on the outside curve of the horn, is usually a little more than two feet. In walking, the buffalo carries its head so that the face is almost level with the back. Its tail is short, reaching to the hocks. Its skin is a grey-black, very thinly covered with grey-black hair, and has practically no oil or sweat glands. Dean Bailey, in his Cyclopedia of Agriculture, Vol. III, calls attention to the fact that the color of the water buffalo is not unlike that of the elephant, and that their motions are similar The resemblance between these two animals is so similar that a casual view of a moving herd of buffalos suggests a roving band of elephants.

OESTRUS, GESTATION, WEIGHT OF CALVES AT BIRTH, AND AGE OF USEFULNESS

Oestrus in the female buffalo does not occur as a rule until the age of two years. It occurs one month after parturition, and recurs regularly every 28 to 30 days until the animal again becomes pregnant.

Definite records on the exact length of the gestation period have been secured only with two cows at Canton Christian College. In one case it was 310 days, and in the other 314 days.

Three calves, from cows in the college dairy, weighed, soon after birth



BUFFALO COWS ARE EASILY MANAGED BY ORIENTALS

The two cows in this picture are from the Canton Christian College dairy herd. The one on the right (referred to in the records as No. 8) produced milk which averaged 15.5 per cent fat for a lactation period of nine months. Water buffalo milk "contains about three and a half times as much fat and nearly twice as much total solids as does European cow's milk." (Fig. 1.)

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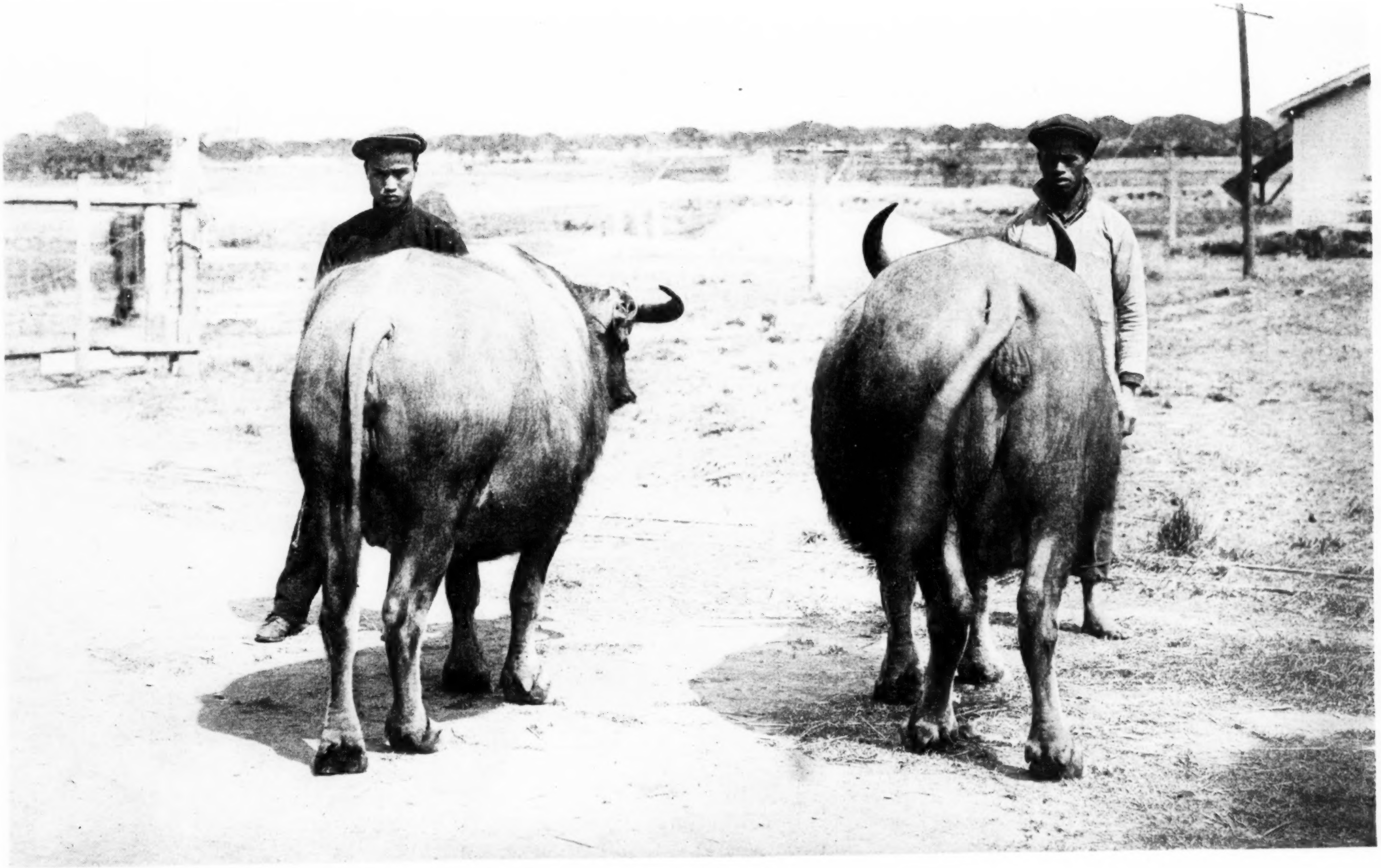

THE SAME COWS AS THOSE SHOWN IN FIG. 1

"There are a number of commendable features in the use of the buffalo cow as a dairy animal." There has been no breeding for milk production in China, yet ordinary buffalo cows give more than 260 pounds of butter fat a year. The average milch cow in the United States gives about 160 pounds (not taking into account the higher possibilities shown by many records where over 1000 pounds have been given.) Due to the absence of sweat or oil glands in the skin, and having very little hair on the body, the animals are easy to keep clean. No cases of tuberculosis have been found among them. (Fig. 2.)

and before they had taken any food, an average of 67 pounds. Their weights were 64, 70, and 67 pounds.

In order to secure a long lactation period and the maximum amount of milk, buffalo cows kept for milk are usually not bred until three or four months after freshening. Although the ordinary buffalo of China gives but a small amount of milk, it is extremely rich in fat, and lactation periods of twelve months are common. The cows are considered profitable for dairy purposes until they are about 15 years old.

TO TELL THE AGE OF BUFFALO

The age of a buffalo is indicated quite accurately by the teeth, up to a certain number of years, similar to the way it is indicated in European cattle. Like other members of the bovine group, the buffalo has no teeth in the front of the upper jaw. The calf is usually born with six temporary teeth in the front of the lower jaw. Two more appear a few weeks later. At about three years of age the middle pair of the temporary teeth are replaced by two permanent teeth. When four years old, the ones on either side of the first pair are up and in use. At five the next teeth on either side of the fourth-year teeth are up, and at six the corner teeth are up and in wear. The age of animals more than six years old is roughly estimated by the appearance of the wearing surface of the teeth in the front of the lower jaw. In the younger animals the teeth have a sharp outer edge, the wearing surfaces slope inward, and the teeth are somewhat angular. As the animals grow older the sharp edges of the teeth wear down, the wearing surface becoming more flat and the teeth more round. After eight to ten years the enamel has worn away

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Note by David Fairchild:

It may be interesting in this connection to quote here from a letter which I wrote in Poona, India, in 1901 to the Hon. James Wilson, then Secretary of Agriculture, regarding the Indian breeds of milch water buffalos which are mentioned by Mr. Levine in this article. The possibilities of utilizing these milch breeds in the Philippines so appealed to Mr. Wilson that he ordered the letter published, together with others regarding plants, as Bulletin No. 27, Bureau of Plant Industry, 1902. In this letter the following facts were reported:

"The carabao or water buffalo (*Bubalus bubalis*, Lyd.) is a well-known object in Manila, and its use as a beast of burden thoroughly understood, but, so far as I am aware, little attention has been paid to it as a milk producer.

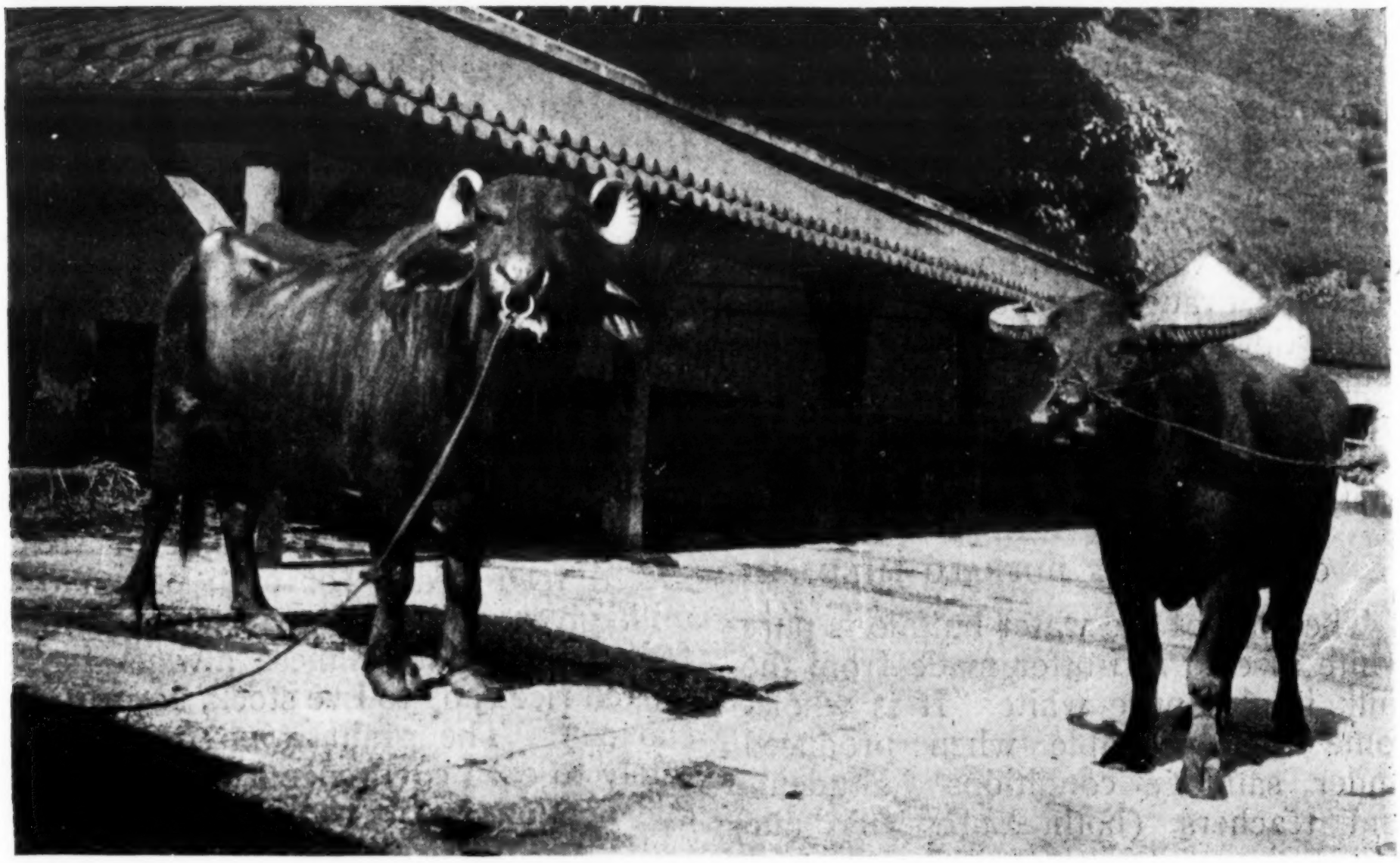
"Unthinking prejudice, which prevents us from eating many excellent things, may play the same rôle in Manila that it does in Ceylon, and forbid the employment of buffalo milk. If this is so it is a great pity, for there is a race of water buffalos which come from Delhi, India, that gives over 30 pounds of milk per day, while the best Sind cattle give only 18, and this buffalo milk is so rich in fat that 12 to 13 pounds of it make a pound of butter, whereas 20 pounds of milk of a Sind cow are required.

"These Delhi buffalos are easier to keep, less expensive, and cleaner (having almost no hair) than ordinary cattle. They sell for about 180 rupees, or $56 in gold, in Bombay, and can be bought at Dawans, the buffalo market, near Grant Road Station, but could be best secured by applying to Mr. Mollison, Director-General of Agriculture for India, at Poona, who could probably be prevailed upon to arrange to have good specimens picked out.

"In general, the animals are priced according to the amount of milk they give, 10 rupees being added to the price for every two additional pounds of milk given per day.

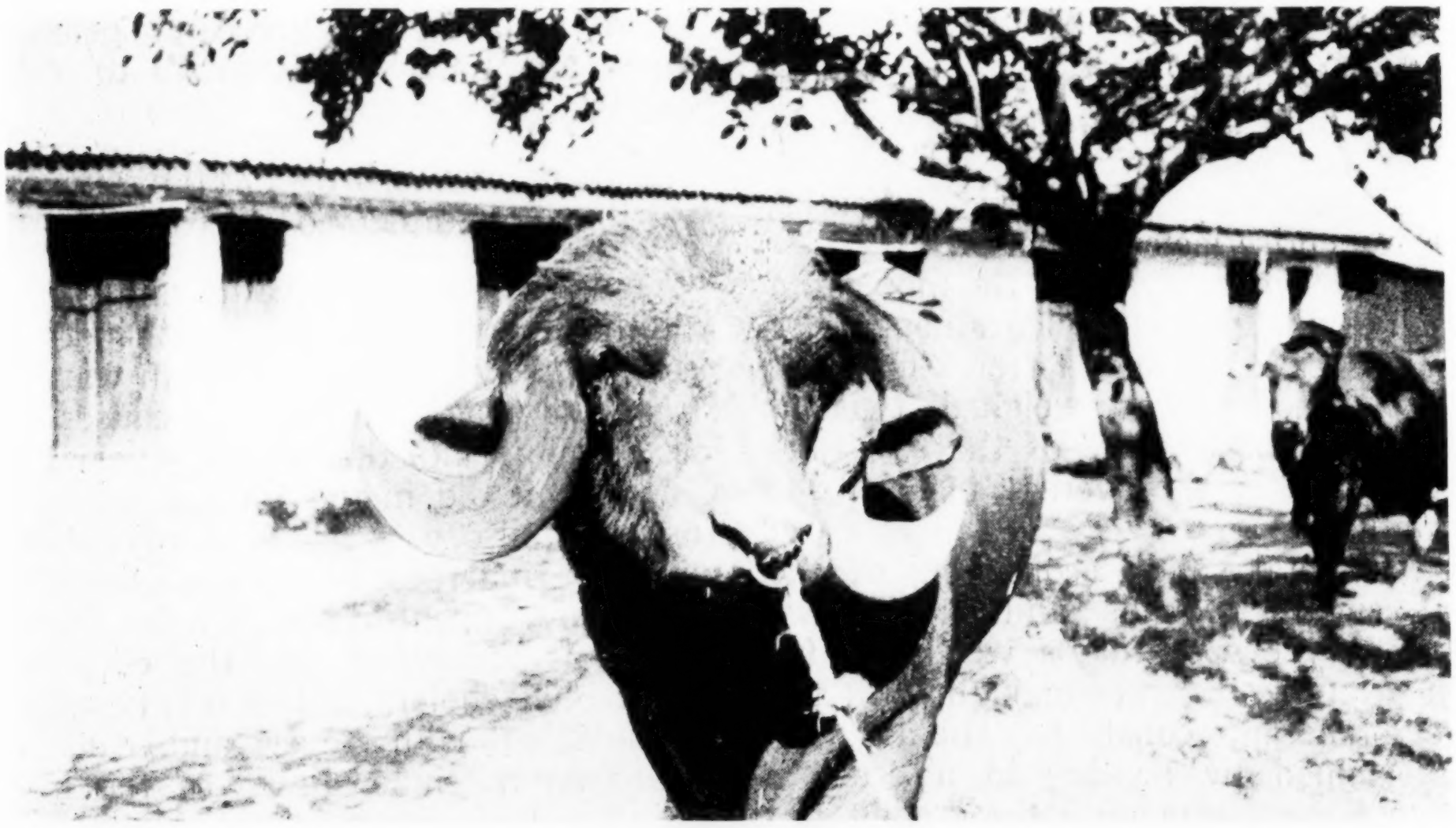
"Another good variety of milch buffalo is that from Gujarát, called the *Surti*. It yields only about 20 pounds of milk per day, and is sold at from $33 to $36 gold. The cost of keeping this variety per day amounts at Poona to only 16 cents gold, and it is considered the most economical race by Mr. Kelkar, the foreman in charge of the college herd. According to him, a dairy should have both buffalos and Sind cattle. The buffalos are better for butter production, and the cattle are superior for milk purposes, because the milk fetches a better price, being, in fact, much preferred to that of the buffalos, which has a bluish color and a slight, though not disagreeable, odor.

"Both the buffalos from Delhi and Gujarát and the Sind cattle are well worth introducing into the Philippines. The buffalos should be tested for butter making, though they cost more to feed than the Sind cattle, which latter will prove, however, especially useful for milk."



INDIAN AND CHINESE BUFFALO BULLS

A "Ram's Horn" buffalo bull (the name coming from its spiral horns) is shown on the left. These buffalos are from the region of Delhi, India, and are much larger than the Chinese animals. The percentage of fat in the cows' milk is about the same, however. The animal on the right is a Chinese buffalo bull. (Fig. 3.)



HEAD OF A BREED OF WATER BUFFALO FROM THE GYR HILLS IN GUJARAT, BRITISH INDIA

It is called the Jaffarabad breed, and is not one of the good milch breeds, being too large in size and a poor milker. Photograph by David Fairchild, Feb., 1902. (Fig. 4.)

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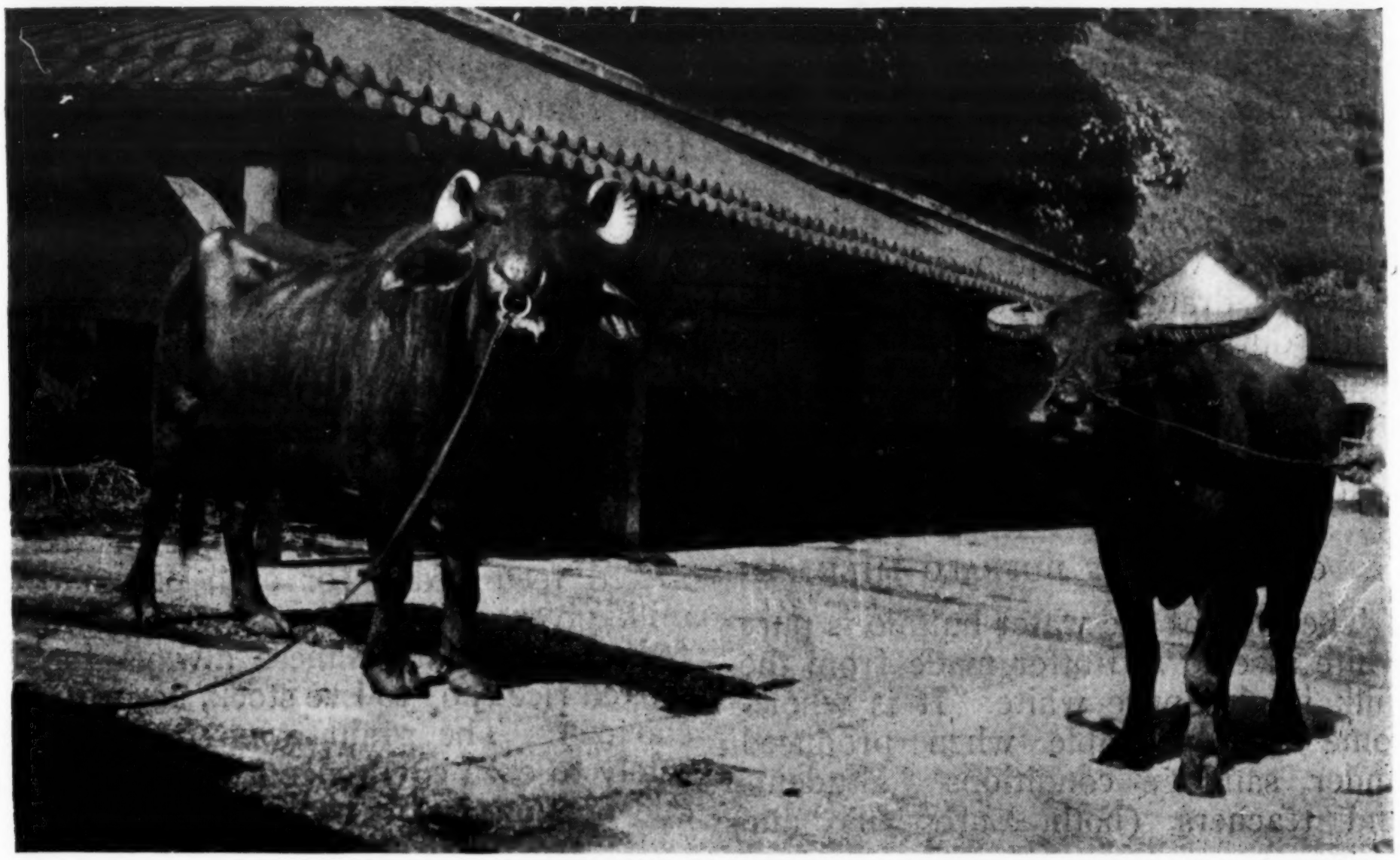

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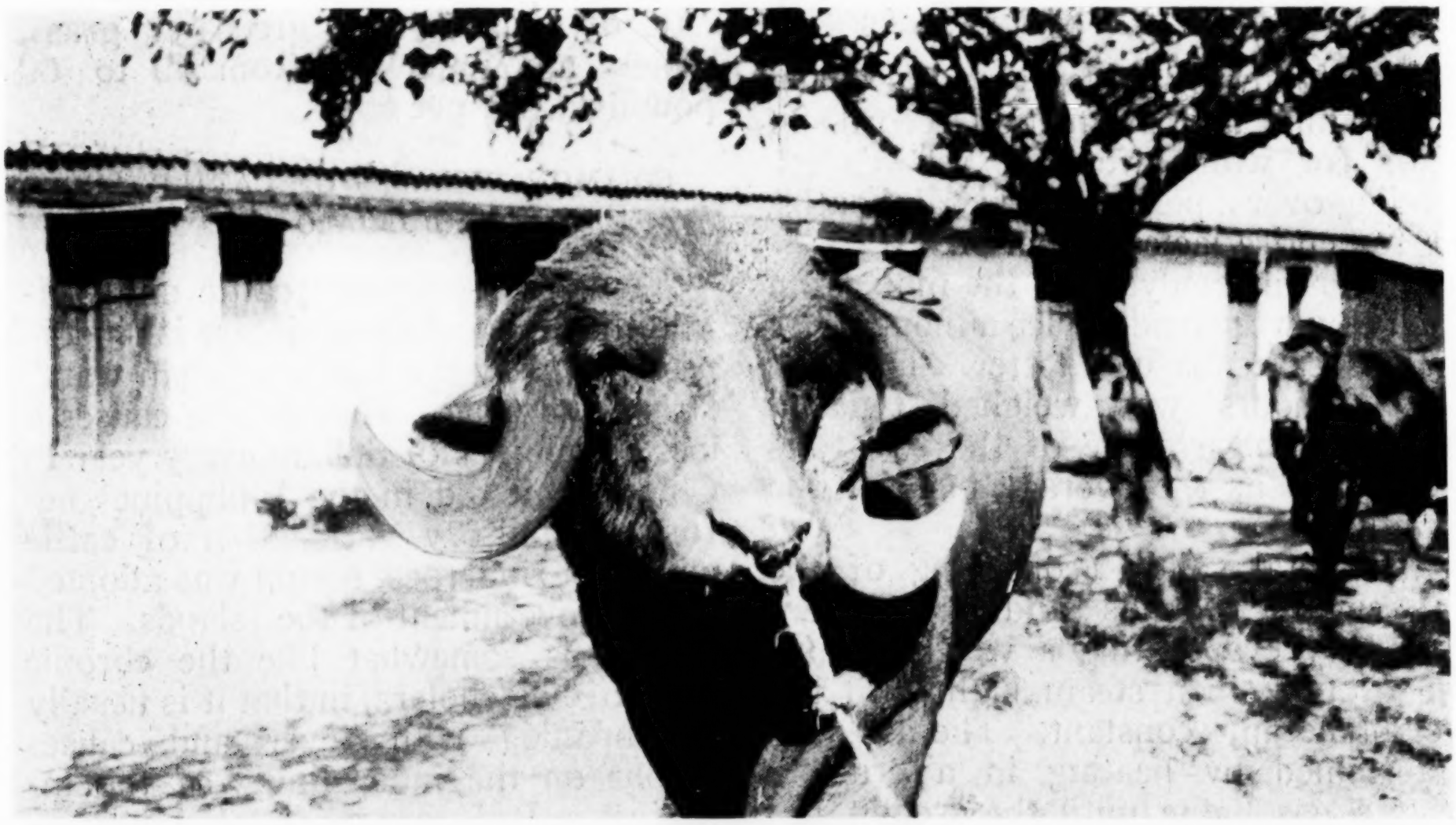

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and yellow centers show on the wearing surface of each tooth.

USES OF THE WATER BUFFALO

Although in the past the principal use of the water buffalo in China has been for draught purposes in the rice fields, during recent years an increasing number are being used for dairy purposes. When the usefulness of the animals for work or dairy purposes is past, they are slaughtered for beef.

CHARACTER OF BUFFALO MILK

The milk of the water buffalo is pure white in color. Butter made from the milk is also pure white. It is wholesome and palatable when produced under sanitary conditions. Students and teachers (both Europeans and Chinese) at the Canton Christian College, prefer drinking buffalo milk to European cow's milk. The objectionable flavor often found associated with buffalo milk is usually due to the production of the milk under unsanitary conditions which generally prevail in most village dairies.

MILK ANALYSIS AND RECORDS

The following tables give the analysis of milk and production records of cows for which we have records extending over a period of several months, or for entire lactation periods.

Butter fat analyses of the milk from each cow were made twice a month with a Babcock centrifugal tester. The milk for 24 hours was weighed twice a month. The average of the two tests was taken as the average test for the month.

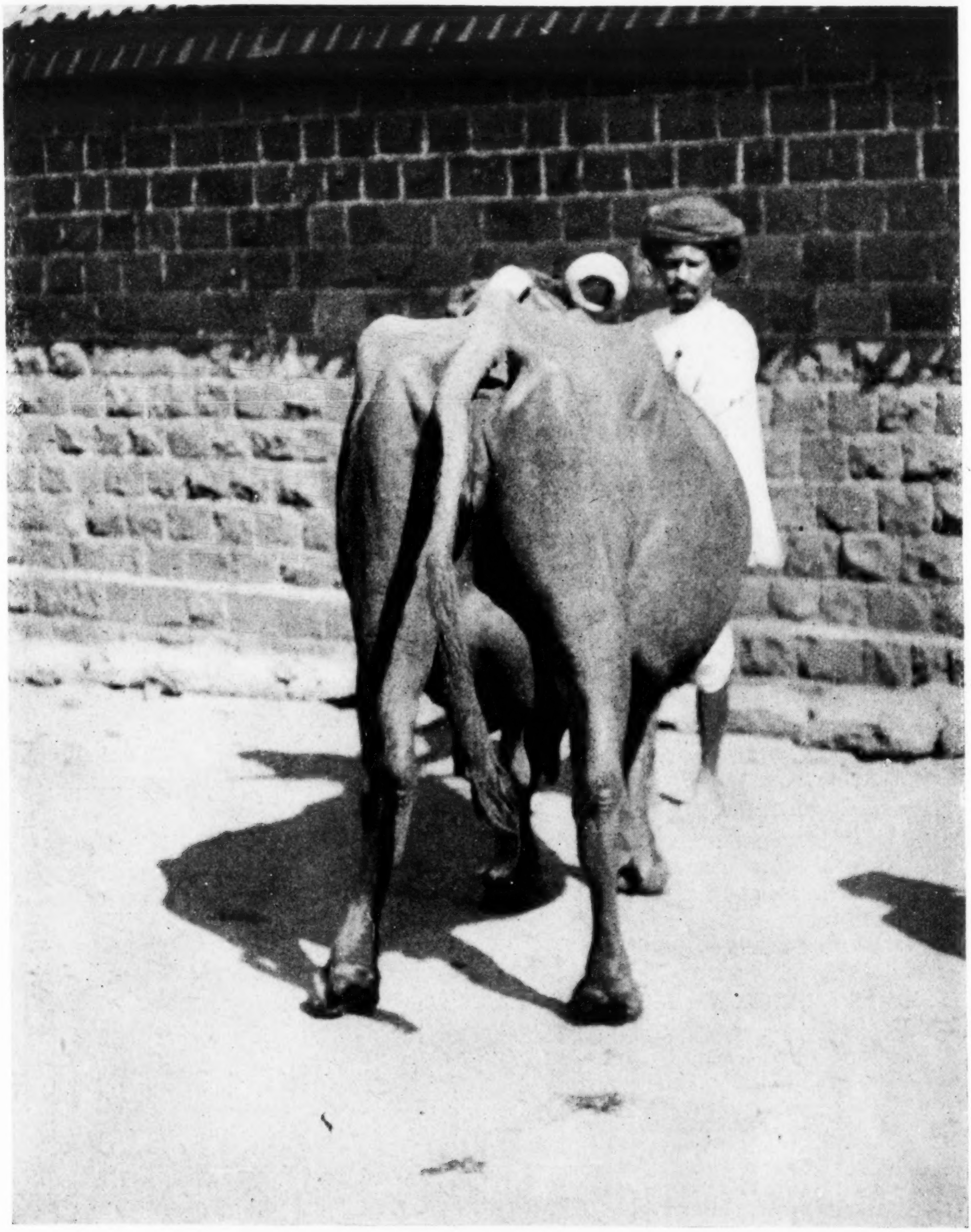
The total solids (consisting of the fat, sugar, proteids and ash) were found by evaporating a weighed sample of milk in a steam bath until the weight became constant. The ash was determined by heating in a crucible over a gas flame until the weight became constant. The proteids were determined by the Kjeldahl method as described by Hawk in his "Practical and Physiological Chemistry," 4th edition, pages 438 and 401. The sugar was found by subtracting the sum of the ash, proteids, and fat from the total solids. The percentages in each case were found by dividing the weight of the final product by the weight of the sample of milk analyzed. Analyses and records of buffalo milk are all from cows in the college dairy.

The buffalo cows were fed a grain ration consisting of two pounds wheat bran and one pound rice chop. Each cow was fed about a pound of this mixed feed a day for each pound of milk given daily. The rice chop was fed cooked (the Chinese always feed cooked rice chop to live stock, never uncooked). The grain was fed separately to each cow twice a day. About one and one-half ounces of salt were fed daily to the cows. The salt was mixed with the grain. About 40 pounds of water were mixed with the rice chop and bran at each feeding, making a very wet feed, the cows drinking it down rather than eating it. (This is the usual method of feeding grain to cattle by the Chinese.) The cows were fed all they could consume, four times a day, of a mixture of green cut grass, which amounted to from 40 to 60 pounds a day per cow.

COMMON DISEASES OF CATTLE AND BUFFALO

Rinderpest.—Among cattle and buffalo the most common disease is rinderpest, called by the farmers "ngau wan." It is contagious. This disease causes a loss of millions of dollars every year in China, as it did in the Philippines before compulsory vaccination of cattle with anti-rinderpest serum was adopted by the government of the Islands. The disease is somewhat like the chronic form of hog cholera, in that it is usually accompanied with fever and causes lesions on the inner lining of the intestines. It is not as fatal, however, as cholera is among hogs.

Tick Fever.—Tick fever, commonly known in the United States as Texas fever, after the region in which it is



A DELHI MILCH WATER BUFFALO

This Indian buffalo cow has given over 30 pounds of milk per day. Thirteen pounds of buffalo milk yield one pound of butter, whereas it requires 25 pounds of ordinary cow's milk to yield the same amount. In Poona, India, these milch carabaos are sold according to their milk yield, 10 rupees being added for each two pounds of increase in yield of milk. Only eight pounds of milk of the Chinese water buffalo are necessary to produce one pound of butter fat. The Indian buffalo produces twice as much fat per pound as do ordinary cows, and the Chinese buffalo produces over three times as much. Photograph by David Fairchild, Poona, India, Feb., 1902. (Fig. 5.)

most common in the United States, is prevalent in south China. Native cattle are largely immune to the disease as they are in Texas, and in India where the disease is common. The disease is caused by a protozoan (*Piroplasma bigeminum*) carried by a cattle tick (*Boophilis annulatus*) in a way similar to that by which malarial fever in man is caused by a protozoan injected into the body of man by the mosquito. The young ticks hatch from eggs laid in the grass where cattle graze. The small ticks emerge from the egg, crawl up the legs of cows and buffalos, and attach themselves to the body of the animal and begin sucking blood, remaining attached to the animal until they have grown to full size. The females, after having been fertilized by the males, drop to the ground and lay their eggs, from 1,500 to 3,000 each, which soon hatch and thus complete the life cycle. Tick fever is fatal to cattle imported from tick-free regions. Fortunately, ticks do not travel far and live only in grass; cattle kept in barns and in dry lots are in little danger from them.

Tuberculosis. — According to Dr. Heanley of the Hongkong Bacteriological and Vaccine Laboratory, tuberculosis has never been found among the buffalo of south China; and during 13 years of inspection of animals and carcasses in the Hongkong government slaughter house where all animals are slaughtered for food are inspected by government inspectors, only two cases in the humped cattle have come to notice. Both cases were bullocks. The disease is as common among European cattle in southern China as it is in America.

DAIRYING IN CHINA

In the past the Chinese have not been consumers of milk. Contact with the Europeans in recent years, however, has taught them the value of this product as a food, and now in the larger cities there is an increasing demand for it. According to old residents in Canton, there were no cows used for dairy purposes in that city 25 years ago. Today there are about 600 cows of European breeds and 100 buffalo cows, kept exclusively

TABLE I.—*Analysis of Milk from Individual Cows.*
(Summarized from detailed records for each cow.)

Number of buffalo cow	Length of lactation period by months	Total amount of milk, pounds	Total amount of fat, pounds	Average per cent of fat
1	Last 6 months only	,520	67.51	12.23
2	8 months	1,081	127.56	11.80
3	Last 6 months only	635	82.23	12.95
4	11 months	1,332	168.03	12.63
5	Last 5 months only	575	75.44	13.12
6	Last 6 months only	555	68.49	12.34
7	Last 5 months only	425	58.74	13.82
8	Last 6 months only	363	56.20	15.48
51	11 months	2,671	257.95	9.65
53	First 7 months only	1,766	185.60	10.51
54	First 9 months only	2,242	271.95	12.13
55	9 months	1,852	219.65	11.86
60	First 6 months only	1,531	171.47	11.20
63	First 6 months only	1,639	167.01	10.19

NOTE.—When these records began, No. 1 had been milking for 4½ months, No. 3 for 2⅓ months, No. 5 for 5 months, No. 6 for 5 months, No. 7 for 8 months, and No. 8 for 8 months. When these records closed, No. 53 was giving 5 pounds of milk a day, No. 54, 6 pounds, and No. 60, 8.2 pounds.

for milk. All the dairies in Canton are managed by Chinese, and their customers are practically all Chinese. In Hongkong, there are several hundred cows kept for dairy purposes. Much condensed milk is also imported and used in China.

EUROPEAN BREEDS IN CHINESE DAIRIES

Most of the European cows in the dairies of Canton and the Chinese dairies of Hongkong are of mixed breeding. All the dairy breeds, and the Shorthorns are represented, although the Shorthorn blood predominates. Blood of the other breeds rank in the following order: Holstein, Guernsey, Ayrshire, and Jersey. The Hongkong Dairy Farm Co., owned and managed by British, has chiefly Hol-

TABLE II.—*Complete Analysis of Buffalo Milk.*

The samples analyzed were herd samples taken from twelve cows in the College dairy in November, 1917. The milking in the morning was begun at four, and in the afternoon at two o'clock.

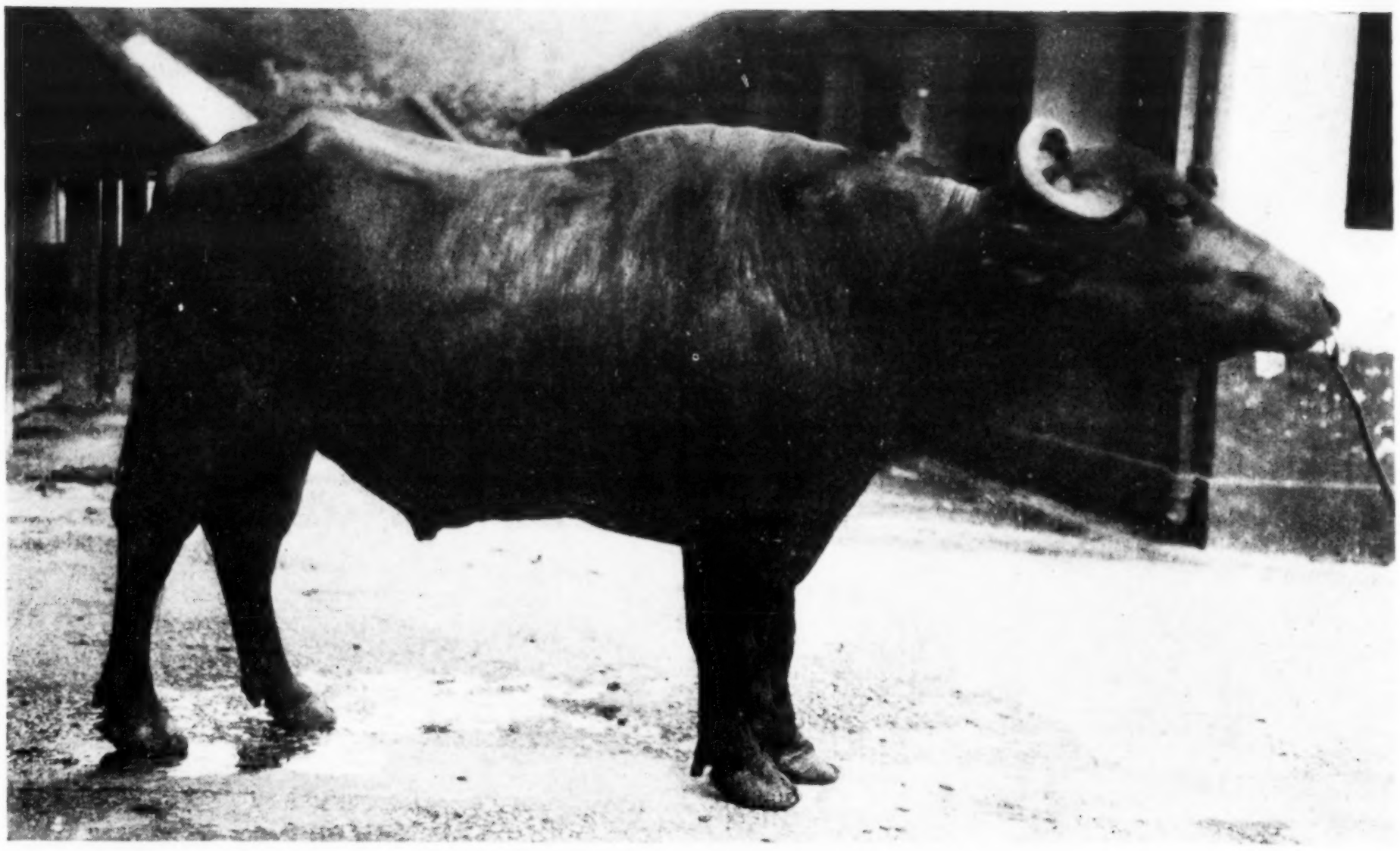
Sample No.	Per cent fat.	Per cent ash.	Per cent protein.	Per cent sugar.	Total per cent solids.	Per cent water.
1. Morning milk.....	11.00	0.94	6.04	4.00	21.98	78.02
2. Afternoon milk.....	12.80	.90	6.10	3.57	23.37	76.63
3. Afternoon milk.....	13.00	.71	5.71	3.32	22.74	77.26
4. Afternoon milk.....	13.63	.74	5.94	3.57	23.88	76.12
5. Afternoon milk.....	12.10	.90	6.14	3.83	22.97	77.03
6. Afternoon milk.....	14.00	.92	6.42	3.87	25.21	74.79
7. Morning milk.....	11.50	.95	5.80	3.70	21.95	78.05
8. Morning milk.....	12.00	.94	6.00	3.60	22.54	77.45
9. Morning milk.....	12.34	1.04	6.28	3.71	23.37	76.63
10. Morning milk.....	12.20	.77	5.90	4.23	23.10	76.80
Averages.....	12.46	.89	6.03	3.74	23.11	76.89

TABLE III.—*Complete Analysis of European Cow's Milk. Analysis Made During January ana February of* 1917

Sample	Per cent fat	Per cent ash	Per cent protein	Per cent sugar	Per cent total solids	Per cent water
1	3.20	0.845	3.18	6.47	13.70	86.30
2	3.50	.840	3.20	5.28	12.82	87.18
3	4.50	.736	3.24	5.18	13.68	83.32
4	4.60	.900	4.10	5.20	14.80	85.20
5	3.80	.780	3.25	5.54	13.37	86.63
6	4.44	.800	3.10	5.60	13.94	86.06
7	3.50	.880	3.80	6.00	14.18	85.82
8	4.10	.888	3.40	5.63	14.02	85.98
9	5.20	.740	3.20	5.30	14.44	85.56
10	4.00	.800	3.05	6.10	13.95	86.05
Averages	4.08	.821	3.35	5.63	13.89	86.11

NOTE.—Samples 1 and 2 are of milk from the Hongkong Dairy Farm Co., in Victoria, Hongkong. The samples are taken from bottled milk from a herd of from 500 to 700 European cows, most of which are Holsteins. Samples 3, 4, 5, 6, and 7 are from the mixed milk of the Sinkee Dairy in Canton. In this dairy 90 to 100 foreign cows are kept, Guernsey and Shorthorn blood predominating.

Samples 8, 9, and 10, are from the mixed milk of four cows in the Canton Christian College Dairy. These four cows are of mixed breeding, Shorthorn blood predominating.



AN INDIAN "RAM'S HORN" BUFFALO BULL

The "Ram's Horn" buffalos come from the region of Delhi, India, and differ from the Chinese buffalos. They are being imported in large numbers for dairy purposes in the Philippine Islands. In milk and butter fat production they rank with the best breeds. (Fig. 6.)

stein cows. This dairy has from 600 to 900 cows of dairy breeds, but no water buffalo.

INDIAN DAIRY BUFFALOS

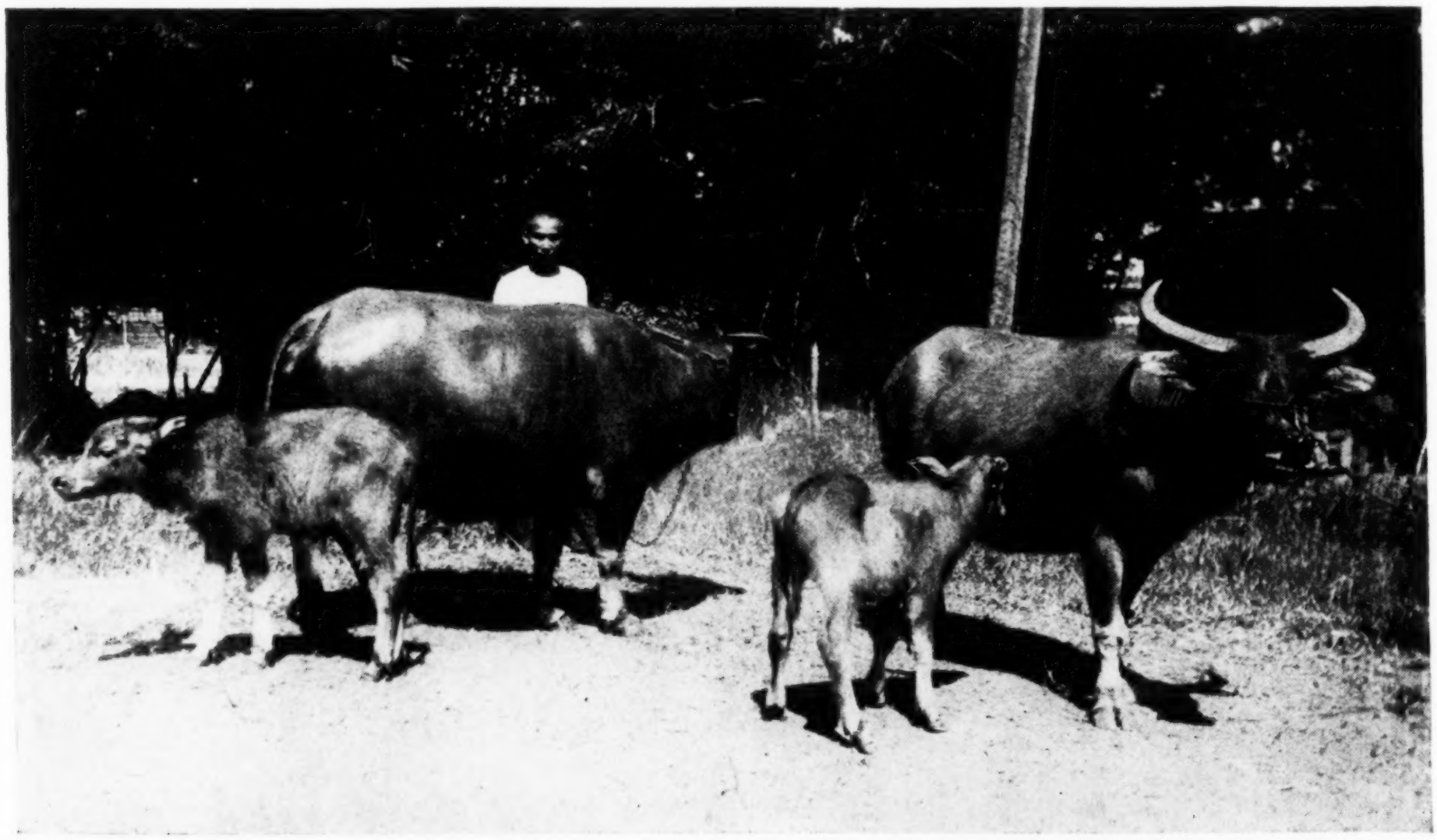
At Kowloon, Hongkong, there is a herd of about 20 Indian buffalo cows managed by Indians. The buffalos in this herd have been imported from the region of Delhi, in the northern part of India. These buffalos are different from the Chinese buffalos, being much larger, some of them 5 feet tall at the withers. They have large spiral horns, and for this reason they are known as the "Ram's Horn" buffalo in the Philippine Islands, where they are being imported in large numbers for dairy purposes. The milk, according to Dr. Gibson, the colonial veterinarian of Hongkong, contains about the same per cent of fat as the Chinese buffalo milk. They are said to give up to 60 pounds of milk a day in India when on good feed. At the Indian dairy in Kowloon, when visited by the writer in January, 1919, the average production for twenty cows, then producing milk, was about 15 pounds. The feed at that time consisted of dry rice straw for roughage, and a little cooked rice chop and wheat bran. The cows were crowded into a dark, poorly ventilated, and dirty barn, and were very filthy. It is the writer's opinion that with proper care and feed, the production of the cows in this herd could easily be doubled. The cows have a well developed mammary system with large teats.

THE BUFFALO COW AS A DAIRY ANIMAL

There are a number of commendable features in the use of the buffalo cow as a dairy animal. The amount of milk in the better buffalo cows of China (see production tables) is not insignificant when we consider that there has been no breeding for production. Ordinary cows give more than 2,000 pounds of milk and 260 pounds of fat a year. *The "Ram's Horn" buffalo from India rank with the best breeds of modern dairy cattle in production of both milk and butter fat.* The fact that the buffalo has practically no

WATER BUFFALOS TAKING THEIR "TWICE-A-DAY"

"Buffalo cows need a bath twice a day in order to keep at their best," although animals which are kept for dairy purposes only have appeared to do equally well with less frequent bathing. Animals used for draught purposes cannot work long in the sun without having their bodies frequently wet with water. This is due to the absence of sweat glands in the skin. (Fig. 7.)



TWO CHINESE WATER BUFFALO COWS AND THEIR CALVES

Note that, while the mature animals have very little hair on their bodies, the calves possess a thin covering of long hair. (Fig. 8.)

sweat or oil glands in the skin makes it an easy animal to keep clean. The scant hair on the body affords a poor hiding place for lice, so that they can easily be detected and eradicated. The absence of tuberculosis among buffalos, and their resistance to the tick fever, adds much to their value as dairy cows. The breeding of the native buffalo of China for milk production, and the importation of Indian dairy buffalos should be encouraged in every way possible, rather than the importation of European cows to China, because of the danger from tuberculosis in the latter.

OBJECTIONS TO THE BUFFALO FOR DAIRY PURPOSES

The chief reason why so few buffalo cows are used for dairy purposes in China is no doubt due to the fact that they give but little milk, and that, *while the milk contains about three and one-half times as much fat and nearly twice as much total solids as does European cow's milk, it usually sells for the same price.* However, as soon as the public knows the value of buffalo milk it should command a much higher price than it does at present. Cows which have not been especially bred for milk production, but were simply selected from ordinary buffalo cows, produce as much as 10 pounds of milk a day for several months. This fact indicates that individual cows, giving a much larger amount of milk, may be secured in a few generations of selection and breeding for dairy purposes.

Some authorities claim that buffalo cows need a bath twice a day in order to be kept at their best. It is the custom for animals to be driven to canals

TABLE IV.—*Analyses of Canton Buffalo Milk and European Cow's Milk Compared.*

(The per cent of fat represents the average of about 800 analyses, and the per cent of the other constituents represents the average of 10 analyses made by the writer.)

	Canton Buffalo milk, per cent	European cow's milk in Canton, per cent	European cow's milk in America, per cent[1]
Fat	12.60	3.80	3.69
Proteids	6.03	3.35	3.53
Sugar	3.74	5.63	4.88
Ash	.89	.82	.73
Total solids (including the fat, ash, proteids and sugar)	23.11	13.89	12.83
Water	76.89	86.11	87.17

TABLE V.—*Analysis of Buffalo Milk in Southern China Compared with That in Other Countries*

	Southern China per cent	India[2] per cent	Philippine[3] Islands per cent	Italy[4] per cent
Fat	12.60	7.95	6.84	7.99
Protein	6.03	4.00	4.97	4.13
Sugar	3.74	5.18	5.16	4.75
Ash	.89	.78	.83	.97
Water	76.89	82.09	82.20	82.16

[1] From Wing: "Milk and Its Products," p. 17.
[2], [4] from Bailey's Cyclopedia of Agriculture, Vol. iii, page 295.
[3] *Philippine Agriculturalist and Forester*, Vol. vi, December, 1917, page 110.

or ponds, places which are not always clean, for this purpose. To overcome this objection, tanks might be constructed in which clean water could be kept for their bath, or they may be washed by pouring clean water over them with buckets, or with a hose where water pressure can be secured. However, animals kept for dairy purposes only, seem to do just as well on very infrequent bathing, or no bathing at all.

FUTURE OF THE WATER BUFFALO IN DAIRYING

In India the water buffalo is the chief source of milk, although it is competing not only with good native breeds of the "humped" variety, but also with all the modern breeds of European dairy cattle.

It is the opinion of the writer that the water buffalo must become the leading dairy animal in the southern half of China, and an important source of milk for the four hundred million people of that land. Unlike the Indians, the Chinese in the past have not been users of milk, but are rapidly taking up the use of this beverage through the example set by Europeans in China.

With a few generations of intelligent selection and breeding among the water buffalos of China, there will be developed a dairy breed of high producing ability, especially in butter fat. The possibility of this is shown in the work at the Canton Christian College by the fact that with no breeding or selection whatever, cows from an ordinary village herd, whose ancestors had never been milked, gave more than 2,000 pounds of milk containing as much as 270 pounds of fat in less than a year. The Indian dairy breeds will also be imported into China

The history of both the dairy and beef breeds of European cattle in most parts of the Philippine Islands has been but little more than keen disappointment and failure. The climate and diseases of the islands are such that European cattle quickly succumb to diseases or degenerate from generation to generation. The last legislature of the Philippine Islands appropriated a large sum of money for the improvement of live-stock in the islands. Not any of this money is being used for the importation of breeding stock of European breeds of cattle. On the other hand the sum of 200,000 pesos ($100,000 U. S. currency) is being used for the importation of the Delhi dairy buffalo from India.

It is difficult to prophesy as to the future of the water buffalo in the United States—if it is to have a future in this country. There is no doubt that the buffalo will thrive in most parts of the South, as far north as the southern part of Oklahoma. Most regions farther north will probably prove to be too cold. The swamps and marshes of Florida, Mississippi, and Louisiana should be especially adapted to water buffalo production.

The fact that buffalo is free from tuberculosis, as well as an excellent producer of milk and butter fat, may result in an attempt at its introduction in the southern part of the United States. The development of dairy buffalo production in this country will help meet the increasing shortage of milk and butter fat supply from animals absolutely free from tuberculosis. Also, large areas of swampy land which cannot be drained but which supply abundant grasses on which the water buffalo will no doubt thrive, will be rendered productive. However, extreme care will be necessary to prevent introducing with the animals the diseases which have not yet found a footing in this country. Further careful study of the water buffalo should be made in its native land in order that we may become more acquainted with this class of bovine before the attempt is made to raise buffalo in America.

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To Increase the Birth Rate

Changes in taxation, and an insurance plan for parents, as methods of increasing Germany's present low birthrate, are discussed by Wilhelm Schallmayer in *Die Umschau* (Nos. 32 and 33, 1919).

He properly condemns present income taxes that fail to make any allowance (as is apparently the case in Germany) or that make an inadequate allowance (as in the United States) for the presence of children in a family. He cites with approval the proposal of Max von Grubin, the Munich hygienist, who proposes that parents shall not be allowed to bequeath their entire estate to their children unless the latter number at least four. Schallmayer and von Grubin believe that many well-to-do parents restrain the size of their family in order that they may bequeath a competence to each child, and they would give the parents an incentive to have at least four children. If they have only two or three, for instance, the proposed law would allow these to inherit only one-half or three-fourths of the estate, to all of which they are entitled under the present law. The undistributed surplus would be distributed, in von Grubin's plan, to collateral relatives in proportion to the size of their families; and in Schallmayer's plan one-half to the collaterals and one-half to the state for eugenic purposes.

Moreover, says Dr. Schallmayer, the cost of the offspring should be borne by the state, through the establishment of a state parenthood insurance bureau, to which all persons of either sex would be admitted, premiums to be based on income. A stipulated benefit would be paid on the birth of each child, up to a limited number, this proviso apparently being to keep poor stock from proliferating unduly in order to get bonuses.

The author points out that a large part of the excessive infant mortality is due to carelessness, and in order to discourage such carelessness he would refuse to pay for a child until it has passed its first birthday.

He declares that steps must be taken to keep the racial contribution of each section of the population proportionate, in order to keep the inferiors from outbreeding the superiors. It is unfortunate that he fails to outline effective steps to this end, since this is in many ways the most important part of the plan and the point where most authors of similar plans have stopped short.

In conclusion Dr. Schallmayer soundly says that the only real insurance of a properly distributed birthrate is the spread of a "eugenic conscience" in the population.

HERITABLE CHARACTERS OF MAIZE

II.—PISTILLATE FLOWERED MAIZE PLANTS[1]

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IN THE "freak" class at the Annual Corn Show held at Lincoln, Nebraska, in the winter of 1913-14, there was exhibited a corn tassel with a heavy setting of seeds. A few seeds are not infrequently found in the staminate inflorescence of maize, particularly in pod corn, and tillers of various corn varieties often end in ears instead of in tassels or have tassels, the central spikes of which are ear like. The freak exhibited at the corn show, however, was a large, much branched affair, wholly tassel-like in form except for the fact that it bore a heavy crop of seed like a well-filled head of broom corn or sorghum. It retained no indication of having had any staminate flowers. It was apparently a wholly pistillate inflorescence, though tassel-like in form.

This freak specimen came into possession of the writer, and seeds were planted at the Nebraska Experiment Station in the spring of 1914. All the resulting plants had normal tassels with no pistillate flowers and normal ears wholly pistillate, and were typical representatives of a large, rather late white dent variety commonly seen in the Middle West. The fact that no abnormal plants appeared was not unexpected, for the parent plant, being pistillate flowered, must have been pollinated throughout by other plants, presumably normal ones. If the abnormality in question were recessive, it would not appear in the first generation from crosses with normal plants.

One of the normal plants was self-pollinated. The progeny of this plant, grown at Ithaca, N. Y., in 1915 and later seasons, consisted of both normal plants and plants with pistillate flowered tassels like the original tassel found at the corn show. Evidently the abnormal tassel is inherited as a recessive to normal. On account of the tassel-like form of this pistillate inflorescence and of its position at the top of the stalk, the abnormality is known as "tassel seed" and is designated by the genetic symbol *ts*, its dominant normal allelomorph being *Ts*.

Wholly pistillate flowered plants appeared also in an unrelated lot of maize grown in 1915. The parent plant was grown in 1914 along with others of the variety known as Pride of the North. All these plants were normal, were rather small and very early, and had red-cobbed yellow dent ears typical of the variety. The seed was from a bulk sample obtained from the Agronomy Department of the Nebraska Experiment Station, the original stock having come from Mitchell, S. D. Several of the 1914 plants were self-pollinated, but only one showed abnormalities in the 1915 progenies. The progeny of this one plant consisted of normal plants and plants that had wholly pistillate flowered tassels. Evidently this abnormality also is inherited as a recessive. At first it was assumed to be identical with the one first described, but this is now known not to be the case. To distinguish it from the tassel-seed type, and because of the more nearly ear-like form of the tassel, it is called "tassel ear" and designated by

[1]This is the second in a series of papers on the heritable characters of maize, the first by G. N. Collins and J. H. Kempton, on "Lineate Leaves," having appeared in the January number of the JOURNAL. The next will be a brief discussion of "Brachytic Culms."—EDITOR.

NORMAL AND "TASSEL EAR" TYPES OF MAIZE

A pistillate flowered maize plant, called "tassel seed" is shown on the right. That on the left is a normal plant from the same pedigree culture. The silks of tassel seed push out of the upper sheaths at about the same time that tassels appear on normal plants. (Fig. 9.)

A LATER STAGE OF THE TWO TYPES SHOWN IN FIG. 9

A normal plant on the left and a tassel-seed plant on the right. The silks of the terminal inflorescence of the tassel seed had been pollinated some days before and are withered, while the silks of the true ears are still fresh. (Fig. 10.)

the genetic symbol *te*, the dominant normal allelomorph of which is *Te*.

DESCRIPTION OF TASSEL-SEED AND TASSEL-EAR TYPES

The peculiarities of tassel seed and tassel ear are best appreciated by an examination of the illustrations accompaying this account. In Fig. 9 are shown two nearly entire plants of the same pedigree culture at the time the terminal inflorescence is pushing out of the upper sheaths. At this stage, ear shoots have not appeared above the sheaths in either the normal or the tassel-seed plant. A latter stage in the growth of such plants is seen in Fig. 10. The tassels, both staminate (normal) and pistillate (tassel seed), appear at about the same time, before the plants have completed their height growth and before ear shoots have appeared from the sheaths. By the time the plants have reached their full height and when the pollen has been largely shed from normal plants (Fig. 10), the silks of the terminal inflorescence of the tassel-seed plants are usually withering on account of having been pollinated. True ear shoots have by this time appeared in the usual position, not only on the normal but also on the tassel-seed plants. Since the terminal silks of tassel-seed plants appear and are receptive before pollen is shed from normal plants of the same stage of development, they are pollinated at once from earlier maturing plants, in which case they soon wither, or if no early normal plants are near, the silks remain fresh and continue to grow until pollen is shed by the normal plants of their own stage of growth. The terminal silks of such plants are usually pollinated before the silks of the true ears of the same plants have appeared. The latter are ultimately pollinated, however, and soon wither, and seeds begin to develop. Whether or not the true ears continue to develop seems to depend upon how fully the tassel silks have been pollinated. When the tassels set a full crop of seed the true ears usually fail to develop far and ripen no seed, but when, from one cause or another, little or no seed forms in the tassels, the true ears develop normally.

Full-grown tassel-seed plants are nearly as tall as normal plants of the same cultures (Fig. 10) and have about the same number of leaves. Tassel-ear plants, on the contrary, are much shorter than their normal sibs. As seen in Fig. 11, tassel-ear plants have nearly as many leaves as normai plants, but have considerably shorter internodes. The terminal silks of tassel-ear plants appear at about the same stage of plant growth as do those of tassel-seed plants. True ears also appear in many cases, but much less frequently than with tassel-seed plants. If the tassel silks are removed at an early stage, true ears usually develop normally, except that they are often tardy in appearing. On the whole, tassel-ear plants are considerably weaker than tassel-seed plants.

The differences between tassel seed and tassel ear with respect to the form of the terminal pistillate inflorescence are well shown in Figs. 12 to 16. In tassel seed the inflorescence is loose like that of most tassels, the individual spikelets being more or less separated. The tassels of normal plants of different strains differ much in the density of their spikes. It is not surprising, therefore, to find variations in the density of tassel-seed inflorescence in somewhat unrelated cultures, such as the second and later generations from crosses with diverse sorts of normal plants. Just such diversities are seen in Figs. 12 and 15. In some cases the tassel-seed inflorescence is fairly dense (Fig. 15), though even here there is little resemblance to an ordinary ear. Some are very loose (Fig. 12), and others intermediate. In rare cases (Fig 12) staminate flowers develop with the pistillate ones throughout the greater part of the tassel. Whether or not these staminate flowers are functional has not been determined. The glumes and palae of such flowers are long, narrow,

NORMAL AND "TASSEL SEED" TYPES OF MAIZE

A second type of pistillate flowered maize, called "tassel ear," is shown on the right, with a normal plant on the left. Tassel-ear plants are much smaller and weaker than tassel-seed plants. They have about as many leaves as normal plants of the same families but their internodes are shorter. (Fig. 11.)

and pointed as in normal tassels, while, in case of the pistillate flowers, these parts are shorter, broader, and more rounded.

The terminal inflorescence in tassel ear, on the other hand, is always compact and distinctly ear-like (Fig. 16). The glumes and palae are short, broad, rounded, and in all respects much like those of true ears. This can be seen not only in immature tassel ears (Fig. 14), but in mature ones as well, particularly when poorly pollinated (Fig. 16).

The terminal inflorescences of both tassel seed and tassel ear are very subject to attacks of smut, much more so than normal tassels. When attempts are made to guard these pistillate flowered tassels against foreign pollen in artificial pollination experiments, the smut fungus develops under the paper bags used in such work even more than when the inflorescences are exposed. Moreover, since the silks protrude from the sheaths while the upper leaves are still closely crowded together owing to the short upper internodes at this stage (Figs. 9 and 11), it is very difficult to protect the silks against accidental pollination. Either the upper leaves must be removed or enclosed with the silks in large paper bags. Again, the weight of the tassels when the seed has begun to develop often causes the tassels to break off in storms. But, fortunately, it is not necessary to make use of the terminal inflorescence in artificial pollinations. If the tassels are removed as soon as the silks appear, the true ears develop with little delay and can be pollinated just as in case of normal maize.

INHERITANCE OF TASSEL SEED AND TASSEL EAR

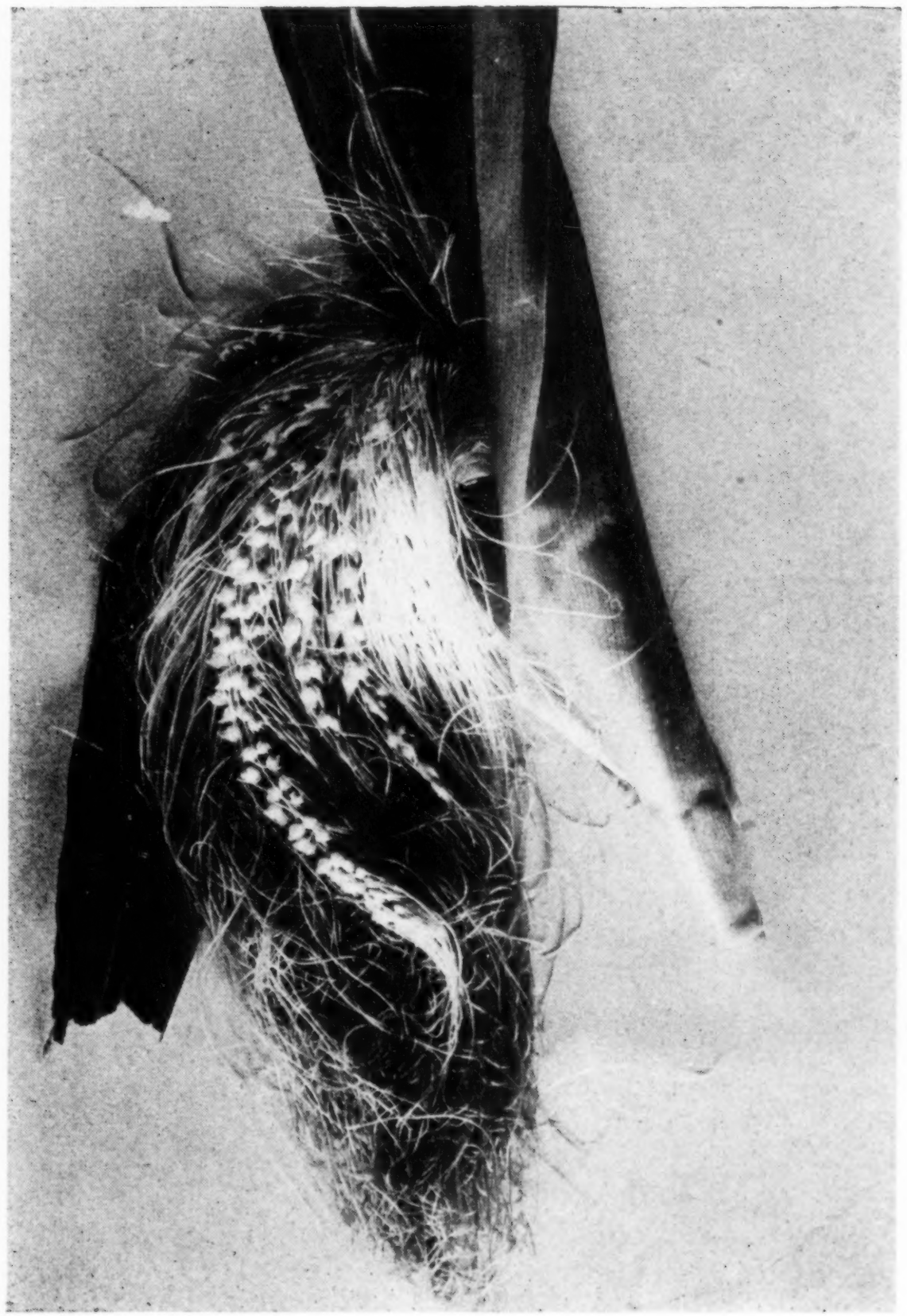
Mention has been made above of the fact that these abnormalities are recessive in inheritance. The original open-pollinated tassel-seed specimen produced 28 normal plants. Several tassel-seed plants occurring as segregates in later generations were crossed with normals, resulting in 64 normal plants. Various F_2 progenies were grown and gave a total of 238 normal to 67 tassel seed. This is a deviation of only 9.3 $\pm$ 5.1 seeds from the 3 : 1 relation expected when parents differ in a single pair of factors. When F_1 plants of some of these same crosses were back-crossed with the recessive tassel seed, there resulted 368 normals and 381 tassel seed, a deviation of only 6.5 $\pm$ 9.2 seeds from the expected equality. Four self-pollinated F_2 normals bred true in F_3, giving a total of 128 normal plants, while 10 other F_2 normals broke up again, throwing both normal and tassel seed in F_3. Evidently, tassel seed is differentiated from normal by the single factor pair *Ts ts*. It is assumed that the recessive tassel-seed plants would breed true if it were possible to test them. But, owing to the lack of staminate flowers, they can neither be self-pollinated nor crossed with other plants of the same type.

Tassel-ear plants crossed with normals gave 24 normal plants in F_1 and total F_2 progenies of 260 normal to 36 tassel ear. This is too great a deviation from a 3 : 1 relation to be due to chance. The expected numbers on a 3 : 1 basis with a total of 296 are 222 and 74, and the deviation is a 38 $\pm$ 5 plants. Such a deviation could not be expected to occur by chance even once in some millions of trials. The possibility is at once suggested that normal and tassel ear differ by two factor pairs, and that the F_2 progenies approach a 15 : 1 instead of 3 : 1 ratio. But the numbers calculated on this expectation are 277.5 and 18.5, a deviation of 17.5 $\pm$ 2.8. Even such a deviation as this would not occur by chance more than once in perhaps one hundred thousand trials. It is, of course, possible that in some crosses the parents differ by one factor pair and in others by two pairs. But no F_2 family with large numbers approached closely either a 3: 1 or a 15 : 1 ratio.

If two factor pairs are concerned, about half of the normal F_2 plants, taken at random, should breed true normal, while, in case a single factor pair

MATURE INFLORESCENCE OF TASSEL SEED

A loose type like this sometimes has staminate flowers and even a few wholly staminate spikelets, particularly at the end of the branches. (Fig. 12.)



TERMINAL INFLORESCENCE OF TASSEL-SEED TYPE

In the terminal inflorescence of tassel seed, the "tassel" is a loose panicle like that of normal plants, but is almost wholly pistillate flowered. The branches are usually slender and the spikelets fairly well separated. (Fig. 13.)

TERMINAL INFLORESCENCE OF TASSEL-EAR TYPE

In the terminal inflorescence of tassel ear, the "tassel" is compact, with the spikelets crowded close together. Both the central spike and the branches are decidedly earlike (Fig. 14.)

is involved, only one-third should do so. Of 17 F_2 normals tested, 5 bred true and 12 broke up. This is certainly nearer the expectation for a single factor pair than for two pairs, but the numbers are too small to allow a definite decision. The F_3 lots not breeding true consisted of 745 normal and 78 tassel-seed plants. This is a deviation from a 3 : 1 ratio of 127.8 ± 8.4 and from a 15 : 1 ratio of 27.5 ± 4.7. While the observed numbers fit a 15 : 1 ratio much more closely than a 3 : 1 ratio, the fit is too poor to be due to chance alone. Moreover, if the F_2 relation were really 15 : 1, in F_3 some 3 : 1 as well as 15 : 1 ratios should have appeared, but none of these F_3 ratios were smaller than 6 : 1, and only 3 of the 17 were smaller than 10 : 1.

A bit of evidence favoring the assumption of two factor pairs differentiating tassel ear from normal is afforded by back crosses of F_1's with the recessive tassel seed. Four such back crosses gave 121 normal and 49 tassel ear. A 3 : 1 relation is expected from such crosses if two factor pairs are involved. The deviation from the 3 : 1 ratio is 6.5 ± 3.8, not a very bad fit. Another back cross, in which the F_1 plant was not closely related to those concerned in the back crosses noted above, gave 53 normal and 43 tassel ear, a deviation from equality of 5 ± 3.3. On the basis of the two-factor hypothesis, some normal plants are expected to have one of the two recessive pairs. Such normals when crossed to tassel ear should, of course, give a 3 : 1 ratio in F_2 and a 1 : 1 ratio from a back cross.

While the facts given above are favorable in part to the idea that tassel ear is differentiated from some normal types by two factor pairs, itself being a double recessive, the evidence is far from convincing. The writer is much inclined to think that there is another way of accounting for the deficiency of tassel-ear plants below the 25% expected on the basis of a single factor pair. Tassel ear is at best a small, weak type. In this respect it is not greatly different from "dwarf," a form described by the writer some years ago. Under ordinary field conditions, dwarf plants almost never appear in numbers approaching those theoretically expected. It has been possible, however, by germinating F_2 and back cross seeds in seed pans in the greenhouse, to show that dwarf is a simple Mendelian recessive. Carefully germinated seeds grown in large numbers have given almost exactly the expected percentage of dwarfs. Dwarfs are apparently often unable to germinate under field conditions or die soon after germination. This is so well known that progenies expected to contain dwarfs are almost always started in the greenhouse and later transplanted to the field.

It is not known as yet whether tassel ear behaves in this respect like dwarf, but, since the plants are small and weak, it seems probable that the deficiency seen in the field may be due to a failure of tassel-ear plants to survive. In this connection it is important to note that most of the records presented above were made from progenies grown under unusually adverse conditions. The soil in which they were grown is a heavy clay. Even the normal plants of the same families showed by no means a perfect stand. Previous inbreeding, in case of the F_3's particularly, had greatly weakened the whole stock. A number of F_4 progenies, grown from these weak F_3 normal plants, were even less vigorous than the F_3's. Out of 15 such F_4 lots, involving 486 plants, in only three lots did any tassel-ear plants appear, and here they numbered only 6 as against 80 normals. In two F_3 families, coming from a cross of tassel ear with a strong and quite unrelated normal stock, there appeared 44 normal and 13 tassel-ear plants, very nearly a 3 : 1 relation. Now the field notes show that these lots were the most vigorous of all those grown that season. It seems likely, therefore, that observed deficiencies of tassel ear are to be explained just as similar deficiencies of dwarf are, but this cannot

be determined until seed-pan germination is tried out.

TASSEL SEED AND TASSEL EAR AS GENETICALLY DISTINCT TYPES

It was stated early in this account that tassel seed and tassel ear were at first supposed to be identical, but that they are now known to be distinct types. The only evidence so far given in support of this statement, however, is the fact that the terminal inflorescence of tassel seed is a loose panicle, while that of tassel ear is more compact, both the central spike and the branches being ear-like in appearance. It remains to be shown that these two abnormalities are genetically distinct.

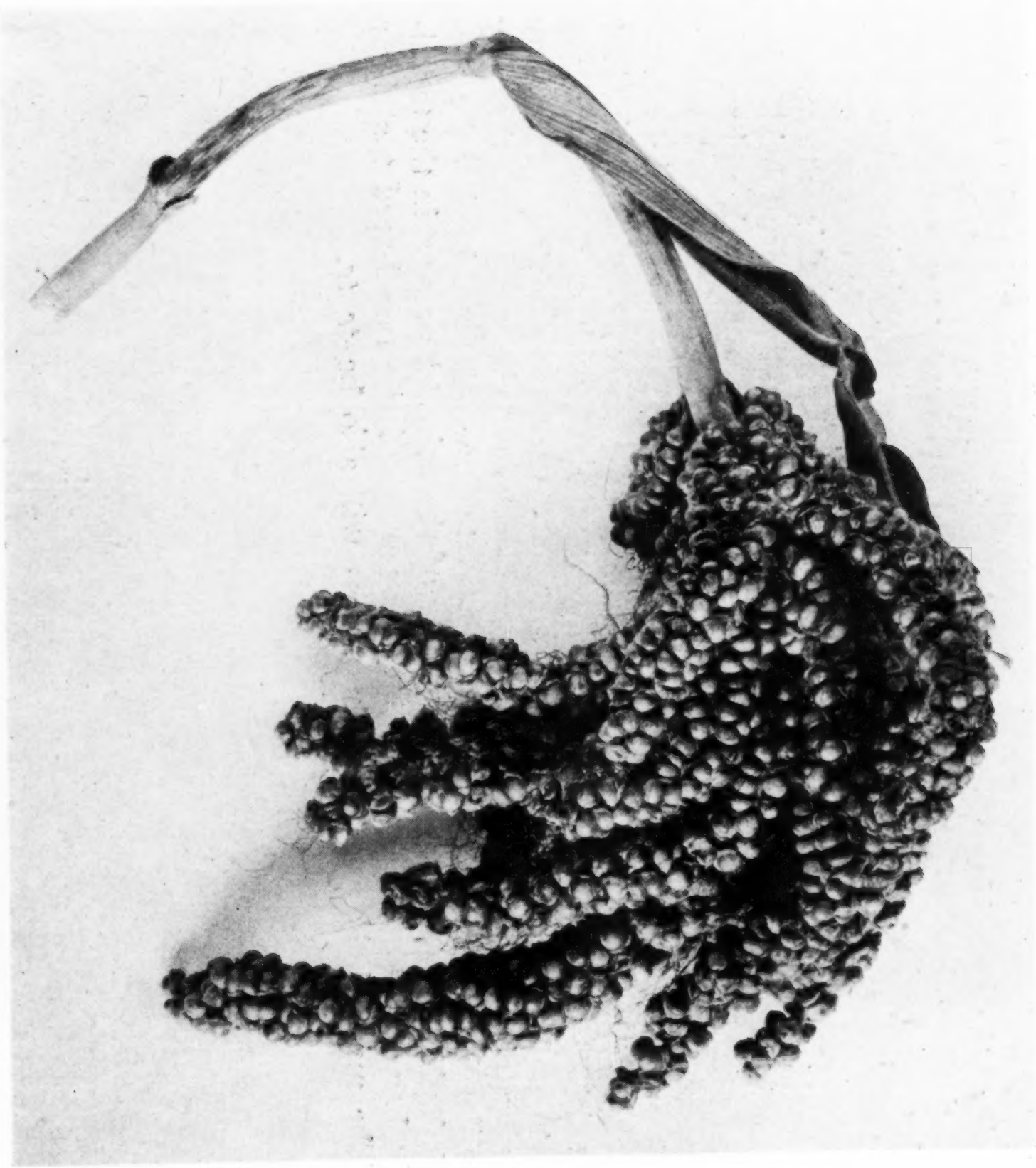
Crosses of Tassel Seed with Tassel Ear.—If tassel seed and tassel ear were fundamentally identical, differing only in density of the inflorescence, vigor of growth, and the like, somewhat as strains of normal corn differ, crosses between the two should give pistillate flowered plants. Of course it is impossible to cross two wholly pistillate flowered types directly, but no mere fact of this kind need bother us long. Conclusive evidence can be obtained from crosses of normal plants, the one heterozygous for tassel seed and the other for tassel ear. Or, better still, a plant heterozygous for one recessive type may be crossed with the other recessive.

If the two recessive types were the same, the cross of two heterozygotes should give 25% of pistillate flowered plants in the progeny. Or, on the same assumption, if an F_1 plant heterozygous for tassel seed is crossed on to a tassel ear and a plant heterozygous for tassel ear is crossed on to a tassel seed, 50% of the progeny should be pistillate flowered. All these crosses have been made and progenies grown. The cross of the two heterozygotes yielded 69 normal plants. A normal plant heterozygous for tassel seed crossed on to a tassel ear gave 40 normals, and a normal plant heterozygous for tassel ear crossed on to a tassel seed resulted in 33 normals. Not a single pistillate flowered plant appeared among the 142 normals. This is regarded as conclusive evidence establishing the genetic distinctness of the two pistillate flowered types. What the double recessive will be like cannot be told until another generation is grown.

Distinct Linkage Relations of Tassel Seed and Tassel Ear.—The story of the linkage relations of tassel seed and tassel ear is only partly known, but sufficient information is at hand to prove that the two abnormalities show distinctly different linkage relations with certain other factors of the maize plant.

A back cross involving tassel seed, *Ts ts*, and a factor pair for pericarp color, *P p*, gave 81 normal plants all with red pericarp and 77 tassel-seed plants all with colorless pericarp. The pair *Ts ts* is, therefore, very closely linked with *P p* or the two pairs are identical. In a similar back cross involving *P p* and tassel ear, *Te te*, there appeared normals with red and with colorless pericarp and tassel ears with red and with colorless pericarp. There were 50 plants of the parental combinations and 56 of the other two combinations of the two characters in question. This is a "crossover" percentage of 52.8, or a deviation from 50 of 2.8 ± 3.3. Apparently, therefore, tassel ear is not linked with pericarp color. Certainly it does not show the same linkage as tassel seed.

It has long been known that a recessive leaf abnormality called liguleless *Lg, lg*, is linked with a dominant plant color called sun red, in which the factor pair *B b* is involved. The crossover percentage commonly observed is about 30. A back cross involving *B b*, *Lg lg*, and tassel ear, *Te te*, produced 96 plants with all but one of the eight possible combinations of these three factor pairs. The crossover percentage for *B b* and *Lg lg* was 29.2, for *B b* and *Te te* 20.8, and for *Lg lg* and *Te te* 45.8. The crossover percentage for liguleless tassel ear is so near 50, deviation 4.2 ± 3.4, that, standing alone, it affords no satisfactory evidence of linkage. There can be little doubt, on the other hand, that *B b* and *Te te* are



A VERY COMPACT FORM OF TASSEL SEED

Even in this extreme form the spikes are hardly ear-like. (Fig. 15.)

TWO MATURE TASSEL EARS

The central spike and the branches are very like small ears. This is seen particularly well in the poorly pollinated specimen (left), and fairly well in the other one, from which birds have removed many seeds. (Fig. 16.)

linked, the deviation from 50% (independent inheritance) of 29.2 ± 3.4 being of such a magnitude that it would not be expected to occur by chance more than once in millions of trials. Moreover, there was in this back cross no great deficiency of tassel ear to mask the results, since the normals were to the tassel ears as 53 to 43. Again, the numbers of all the several classes were very close to expectation on the basis of the crossover percentages noted. Of the 96 plants, 50 were non-crossovers, 44 single crossovers, and 2 double crossovers.

Unfortunately there are no data available at present with respect to the possible relations of *Ts ts* with *B b* and *Lg lg*. There are, however, back cross data including no less than 3,700 plants involving *P p* and *Lg lg*, and 2,600 involving *P p* and *B b*, all without any indication of linkage. It follows, therefore, that tassel seed and tassel ear are not only distinct genetically as well as morphologically, but that they belong to distinct linkage groups.

Identifying the Double Recessive, Tassel Seed Tassel Ear.—It is not known what sort of plant the double recessive, tassel seed tassel ear, will be. There is available abundant material, in some of which *ts ts te te* should appear next season. If it should prove to be like one of the types described in this paper, tassel ear for instance, a 9 3 : 4 relation should be found to exist between the three phenotypes. Ordinarily, in such a case as this, it is necessary to conduct further breeding tests in order to distinguish the phenotypically alike, but genetically different single and double recessives. But such tests might here encounter serious difficulties. The most likely procedure, in case the double recessive is not distinguishable from one or other of the single recessives, is to cross random samples of the recessive plants with *both* heterozygous tassel seed and heterozygous tassel ear. This would involve considerable difficulty unless two true ears or one ear and the terminal inflorescence develop on each plant, a thing hardly to be expected in plants so weak as tassel ear. Of course it would doubtless be possible to make up the two classes of heterozygotes so that they differ from each other and from the recessives by dominant aleurone or endosperm characters. A single ear of each recessive could then be pollinated by both heterozygotes and the resulting seed separated into two lots corresponding to the two heterozygous parents. But all this would require much time and no little effort.

Fortunately, no such tests should be necessary in the particular case under consideration. The known linkage relations of tassel seed and tassel ear with other characters should make the solution of the problem much less difficult. To emphasize the aid that some knowledge of linkage affords in such a problem as this is the only excuse that the writer can plead for this attempt to cross an apparently difficult bridge before he is sure that such exists. It will not be difficult to introduce both *P p* and *B b* into the cross of tassel seed and tassel ear. Any resulting pistillate flowered plant with colorless pericarp is almost certain to be *ts ts*, and there are about four chances in five that any pistillate flowered plant having the factor of the pair *B b* present in the tassel-ear parent of the tassel-seed tassel-ear cross will also be *te te*.

EUGENICS AND OTHER SCIENCES

Some Comments by Frederick Adams Woods on an Article in the Eugenics Review

THE *Eugenics Review,* which is the official organ of the Eugenics Education Society of London, contains a comprehensive and suggestive article on "The Relations of Eugenics to the Other Sciences," by Harry H. Laughlin.

In regard to genealogy the author says: "Genealogies and biographies have existed since civilization began. At present the genealogist strives to work out the family net-work, giving the names, dates, and connections. He is often content to stop there. The task of eugenics is to prevail upon all of these workers to provide a description of the natural, physical, mental, and temperamental qualities of each member listed in the net-work. When this is done, the genealogist supplies a record of practical pedigree-value, one which can be used in tracing the descent and re-combination of natural qualities within the family-tree."

The author's remarks on the relation of eugenics to biography are open to some question. "The history of mankind is equivalent to the biographies of all of its human units. The different weights that different men have supplied in making history is so vast that we often shorten the statement by saying that 'the history of the race is the biographies of its great men.'"

This is very likely true, but the relations of great men to the ages in which they have lived are doubtless reciprocals, and many writers contend that great men are largely the products of their times. There has been but little done in the way of systematic and quantitive study on this problem. What little research there is, points towards the view that great geniuses are born as such, and lead the way in creating new epochs. More investigations are much to be desired.

The author's following statement we take exception to, simply because we do not believe that it is at present practical: "The eugenicist has the task of convincing the writer of biographies that one of his principal duties in the description of the life of his subject is to resolve the factors of nature and nurture—to evaluate the effect of specific hereditary traits in making the human machine that turned out the specific product which he is describing as a life's contribution to history."

It is not possible for a biographer, or historian, or indeed any writer, even if he be equipped with the utmost scientific knowledge, to resolve in any one individual "the factors of nature and nurture" or to "evaluate the effect of specific hereditary traits." This can be done only when large statistical totals are available, and then only when special schemes have been devised. Any assertion that such and such a trait was inherited from such and such an ancestor, or that such and such a characteristic was "clearly the result of early influence," etc., etc., is not only pure dogmatism, but it is often pathetically naïve.

Some day we may know so much about the limits of heredity and environment, *in general,* for all kinds of specific traits, both mental and moral, that we can rightly suppose that what is true in the general is probably true *in the individual;* but for the present it is idle for the biographer to do more than carefully trace the complete immediate pedigree of his subject in all its ramifications and to record as many as possible of the facts. These facts can be made the bases of statistical inquiries.

In regard to sociology the author says: "There is a tendency on the part of sociologists to ascribe practically all of the factors of human destiny to

matters of environment. On the other extreme we cannot, of course, ascribe everything to heredity. The great problem now, as always, is to make a true analysis of human reactions, ascribing to environment its true forces, and to hereditary qualities which react to environment their due weight. No headway can be made in claiming undue weight, either by biology or eugenics, for heredity, or by sociology or euthenics, for environment."

We should say that perhaps a certain amount of headway may be gained even if an *undue* weight be given to heredity on the one hand or environment on the other. But it will be only the headway that springs from controversy. The true and scientific headway should be the evaluation of changed environment when acting upon comparatively identical germ plasms, and the evaluation of differing germ plasms when nourished in comparatively identical environments. It should be insisted upon that we already know, from the confirmatory results of a number of researches, that, as far as important human differences are concerned, these differences are probably the result of differences in the chromosomes of the primary germ cells.

THE DEATH OF RICHARD SEMON

PARTICULARS regarding the death of Richard Semon, author of the mnemic theory of heredity, are given by his intimate friend, August Forel, in a recent issue of *La Libre Pensée Internationale*.

Born in Berlin in August, 1859, Semon studied zoölogy with Ernst Haeckel at Jena and secured the degrees of Ph.D. and M.D. Then, Dr. Forel recalls, "he made a trip to Africa, studied at the zoölogical station in Naples, became assistant to O. Hertwig, and finally *privat docent* in anatomy at Jena.

"After being made professor extraordinary in 1891, he undertook, with some aid from P. de Ritter, but mainly at his own expense, a trip to Australia and the Malay archipelago, to study the most primitive mammals and the pulmonary fishes, their manner of life, their structure, and their development. It is enough to say (I cite Lubarsch) that in twenty years seventy-seven different savants have published six huge volumes in folio with 343 plates and 1,810 text illustrations, in 112 different lines of research, on the scientific results of Semon's voyage; one can thus understand the enormous amount of work he accomplished in the antipodes.

"He himself wrote in 1895 (second edition in 1903) a narrative of his journey entitled, 'In the Australian Bush,' published by W. Engelmann, Leipzig. This narrative is captivating in the highest degree, as much from the scientific point of view as from that of human interest. In it Semon shows all the delicacy and depth of his feelings, as much as the clear, perspicacious and assimilative genius of his investigative spirit. I strongly recommend a perusal of this book to every person with a little education.

"In 1897 Semon left Jena and his professorship to go to Munich. In working over his Australian material, he reflected on the great problems of biology, on the problem of life. Realizing how idle the sophistic disputes between 'vitalists' and 'mechanists' remained as long as the origin of heredity was not clearly understood, he gave himself up to a profound study of the latter and of its relation to the characteristics acquired during every individual life, vegetative and cerebral.

"With a flash of genius, Ewald Hering had remarked, 'Instinct is analogous

to a memory in the species.' But he was laughed at, and gave up instead of developing his idea. Taking up this suggestion from Hering, Semon tested the question by a study of the effect of irritations on living matter, and the persistence of this effect as an 'engram,' either directly in the cells or indirectly through the nerves and the brain; not only in the individual, but, passing through the germ-plasm, in heredity.

"Thus in 1904 he came to write his fundamental work on the 'mneme' as the conserving principle of organic life; and in 1909 followed a supplement on 'mnemic sensations' in which the terms 'engram,' 'ecphory,' 'homophony,' and the like were applied to the heredity of all living beings as well as to human mentality.

"Persons as small as they are superficial, slaves of prejudices and phrases, have been unable to see in all this anything more than 'new names for old ideas,' when as a fact their own lack of ideas—that is, the routine of their old psychology and biology—was overthrown from top to bottom by Semon."

"In addition," Dr. Forel continues, "Semon had clearly proved the inheritance of acquired characters (which amount to the 'mutations' of de Vries) by his researches on the origin of the sole of the human foot, etc. Moreover, he prepared during recent years a book on the pathology of the mneme, which I would rejoice to see published. But he had suffered profoundly from the death of his wife, which occurred in 1918. He cherished her the more because, having no children, they worked together. In addition, Semon, a declared foe to all chauvinistic hatred between peoples, had suffered deeply from the war.

"On December 27, 1918, the day on which he shot himself, he wrote me the following letter:

"'My very dear friend, it is to you that I write my last letter. I strongly suspect that you will blame me for voluntarily ending my life. I would not have done so—I would have sought and found in my work the needed strength, strength which I possess, to endure the atrocious isolation in which I was plunged by the death of my wife, the incomparable companion of my existence. We lived together in the loftiest mental intimacy. But work has become impossible to me, for my mind, especially its mneme, is failing more and more. In others, that begins only at the age of eighty; with me, twenty years sooner. In this domain I am marked by heredity.

"'Having tasted of the fruit of the Tree of Knowledge, and noticing in myself the first traces of evil, I do not wish to stain the work of my life by a termination of inferior value. On the other hand, I cannot exist without work.

"'Having no one to support, I leave no vacancy. Forgive me, then, in understanding me.

"'I owe you much, dear friend—stimulation of ideas, great encouragement of my efforts and of my achievements. I leave my last work, 'Self-consciousness and Brain,' half finished. But as it clearly contains, in my opinion, a useful nucleus in the first six chapters, already completed, I have arranged for its publication, at least as a 'torso.' I regret that I shall no longer be able to have your counsels on this work.

"'Adieu! May you and yours live happily. My heart remains full of esteem and gratitude to you.

"'Your faithful

"'R. Semon.'"

In the early years of its appearance, Semon's theory attracted much attention in the biological world. While it gained a number of eminent adherents, most geneticists considered it highly mystical in nature and attached little value to the experimental and other evidence which its author cited in its support. In recent years not much has been heard of it.

A DISCUSSION OF POPENOE AND JOHNSON'S "APPLIED EUGENICS"

AND THE QUESTION OF HEREDITY VS. ENVIRONMENT

MR. PAUL POPENOE,
Washington, D. C.

DEAR SIR:

Your publishers have been kind enough to send me a copy of "Applied Eugenics," by yourself and Professor Johnson, and I have been reading it with a great deal of interest and satisfaction. I was a student of Galton many years ago, and have since, from time to time, read such works on eugenics as seemed most significant. I have always given the subject a large place in my teaching and have regarded it as of equal practical importance with sociology proper.

Your book I think much the best that has appeared for my purposes, and mainly for two reasons. First, it contains a much larger body of well-considered social applications, and, second, there is evident throughout a non-partisan spirit and a desire to come to an understanding with students of the social sciences. It is especially in this latter connection that I have felt inclined to write you.

Without doubt eugenics has as yet made a far slighter impression upon students of the social sciences than its intrinsic importance entitles it to make. Why is this? While mere ignorance may largely account for it, I think that with intelligent people an equally important factor has been the narrow and particularistic spirit in which eugenics has commonly been advocated. The eugenists have seemed not so much to be proposing a line of research and practice supplementary to history, economics, sociology, education and the like, as striving to depreciate and practically to supplant these branches of learning. A specialist in one of them would take up a book or article on eugenics and, observing that the class of facts with which he was most familiar were ignored or scoffed at, would naturally conclude that the author was some kind of a crank whose ideas could have no serious interest for himself.

There has been ground for this impression, it seems to me, even in the case of the ablest eugenists. Take Galton, for example. I would not call anything that he wrote sociology, properly speaking, or admit that he saw anything from a sociological standpoint. He collected facts of individual and family biography to throw light on his biological theories, but I do not think he ever shows that *conception of social organization and development as a living whole* which, I should say, was the essential thing in sociology, or, for that matter, in history, economics, etc. Accordingly learned and open-minded men, like James, Bryce and many others, were unfavorably impressed with his views and perhaps did them less than justice.

I take it that the misunderstanding between biological and social science is one that can hardly be healed by an appeal to specific facts, because it rests rather on a difference in the presuppositions, the points of view, hypotheses and problems which control the perception and interpretation of facts. I seldom quarrel with the facts put forth by a eugenist, but can very often see an entirely different interpretation of them.

Now let me make one or two constructive suggestions. I think one thing necessary is a clearer fundamental theory of the underlying relation between the social and biological processes, in which, perhaps, might be found a

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[1] "Applied Eugenics," by Paul Popenoe, former editor of THE JOURNAL OF HEREDITY now Gen'l Sec'y American Social Hygiene Assn., and Roswell H. Johnson, University of Pittsburg. Pp. 459, with illus., charts, etc. MacMillan & Co., New York, 1918.

basis upon which students of both might build.

The overworking of the "nature *vs.* nurture" antithesis has done incalculable harm in giving the discussion a partisan character. It should be supplanted, I think, by the conception that there are two parallel and interrelated processes, the biological and the social, equal in importance but quite different in character, supplementary to each other and not, properly speaking, in opposition to each other at all. The chief seat of the former is the germ-plasm; of the latter, the stream of psychical communication through which social organization and development take place. Sociologists, economists, historians, jurists, political scientists, social workers and the like are primarily engaged with the latter, which (let biologists note) is a real system of organic life and not a mere "environment" of the germ-plasm. But as their whole process, biologically speaking, is founded on the germ-plasm, they must study eugenics.

In a similar sense the biological process is based upon the social, which in general determines the environment in which the germ-plasm lives and, more particularly, the conditions of selection which favor some types and suppress others. Eugenists, then, should study sociology.

I think it should be recognized, also, that human heredity is, in general, far more plastic than that of the lower animals. I mean, not that the principles of heredity are different, but that the characters inherited are themselves, for the most part, plastic—teachable instincts instead of rigid, for example. A recognition of this would abate many controversies, reconciling, largely, the sociologist's faith in education with the eugenist's conviction of the impossibility of changing inherited traits. This principle is, of course, good Darwinism, and you recognize it on page 406, where you say "All that man inherits is the capacity to develop along a certain line under the influence of proper stimuli . . ."

I may add that a book I have recently published ("Social Process," Charles Scribner's Sons) contains four chapters dealing with Social Factors in Biological Survival which deal somewhat more fully, though inadequately, with this line of thought. If you care to review these chapters, or the whole book, in the JOURNAL OF HEREDITY, I have no doubt the publishers will send you a copy for that purpose.

Let me say again that I have read your book with profit and that I find myself agreeing with most of what you say relating to "the eugenic aspect of specific reforms."

Sincerely yours,
CHARLES H. COOLEY.

JOURNAL OF HEREDITY
Washington, D. C.,

PROFESSOR CHARLES H. COOLEY,
Ann Arbor, Mich.

DEAR PROFESSOR COOLEY:

Mr. Popenoe, has forwarded to me your letter to him on the subject of his book, "Applied Eugenics." If agreeable to him and to yourself, I should like to publish this letter in the JOURNAL OF HEREDITY, or perhaps the greater part of it, or perhaps you would make this the basis of a more extended review. I think it would be a fine idea to have the heredity environment problem discussed from the sociological standpoint.

For my part I have believed for a number of years that the tangle can only be unravelled by treating both factors as a problem of differences.

This I had an inkling of, but no clear conception of at the time I published "Heredity in Royalty," 1906, for there I sometimes say that 90% is due to heredity. In another place I say that all the rough differences are due to differences in the germ-plasm, in spite of the considerable differences in the environment. This latter point of view is more elaborately worked out in an article published in the JOURNAL OF HEREDITY in 1917, called "Significant Evidence for Mental Heredity."

I do not see that your "stream of psychical communication through which social organization and development

take place" is anything more than a part of what we understand as nurture, or environment. This has varying effects on different functions, more effect on some than on others. It undoubtedly has a great effect on one's modes of speech, and on manners. The question is, how much on each trait or function?

All true scientists should aim, not at a partisan discussion, but at a more measured estimate as to what can be done, and what *cannot* be done by furnishing ameliorative environments.

There have not been as yet more than about a half a dozen researches in this direction, but they undoubtedly foreshadow the future as far as the study of human heredity has a bearing on psychology, sociology, and history.

I hope you may be brought to ponder on this point and see that, by the statistical method, sociologists can slowly but certainly measure the limits of chromosome control.

With pleasant remembrance of former correspondence that we had some years ago (I think it was on my "Laws of Diminishing Environmental Influence," believe me

Sincerely yours,
FREDERICK ADAMS WOODS.

DR. FREDERICK ADAMS WOODS,
Washington, D. C.

MY DEAR DR. WOODS:

I shall be glad to participate in an informal discussion of the general relation of social to hereditary process, so far as I have anything to contribute. I think that, in the lack of an understanding upon this, discussion of detailed questions is mostly futile.

It is true, as you say, that the stream of psychical communication through which social organization and development take place is a part of what biologists understand as nurture or environment. But they should understand also that this, though true from their standpoint, is a wholly biological conception of the matter and not at all that of the social sciences. I mean that it looks upon the germ-plasm and the growth of biological individuals as the central interest and regards social life, so far as it regards it at all, as a surrounding condition, or "environment."

Now for the sociologist the matter is quite turned around. For him social process, social organization and development, is the center of interest. This is a distinct evolution of organic life, of the utmost complexity and human interest, and not only one but many sciences are preoccupied by it. He sees the germ-plasm and other biological phenomena very much as the biologist sees society, as a sort of side-issue, an "environment" (although that word is not used, it might be, logically enough), a mere conditioning circumstance of the evolution with which he is familiar. And he has just as good ground for his attitude as the biologist has for his. One process is not more original and causative than the other. The biological controls the social in a certain sense, in another the social controls the biological.

I feel sure that no statistical studies from the merely heredity-environment standpoint will convince students of the social sciences, because such studies invariably, or almost invariably, involve premises they do not accept. A classic example is Galton's "Hereditary Genius," which seems to a sociologist to beg the whole question in a paragraph or two, in which he asserts that great and enduring reputation may be treated as identical with natural genius.[1]

The only way I see, then, of making a start towards a *rapproachement* is by agreeing upon the parallel and coördinate nature of the two life-processes, each party endeavoring to get the general point of view of the other, and then proceeding to investigate the large class of questions in which they are both involved. But this will be very difficult, because habits of thought are not likely to be changed by argument.

I think, however, that the latter part of Popenoe and Johnson's "Applied

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[1] Enduring reputation is certainly not identical with natural genius, but the two are to some extent correlated. To determine the approximate amount of this correlation would make interesting subject for research.—F. A. W.

Eugenics" is much more reconcilable with the sociological point of view than anything else I have seen, from biologists, covering similar ground.

I am quite willing that you should publish any part of my letters that you think may interest your readers.

Sincerely yours,

CHARLES H. COOLEY.

NOTE BY F. A. WOODS.—By way of further discussion I should only like to make three further comments.

1. I agree with Professor Cooley in his idea that a social group may be regarded and studied as if it were a biological organism, but this idea does not prevent us from measuring the differences between individuals who compose the group and attempting to devise means of studying the various reactions of the group or the individual.

2. I do not agree at all with Professor Cooley's statement that "human heredity is far more plastic than that of the lower animals," as I have already shown the truth to be quite the contrary by an analysis of the degrees of artificial modification obtainable in the organic series of plants and animals. This is the above cited "Laws of Diminishing Environmental Influence."[2]

3. I fully agree with Professor Cooley when he says that habits of thought are not like to be changed by argument. No, not by argument which in the past has been too much the method of the sociologist but by measurements and by inductive science which has only recently become the method of the biologist, the psychologist and the philosopher of history.

The Eugenic Bearing of Taxation

Assessment of an income tax by dividing the total income of a family among all the members, old or young, and taxing each separately, is recommended by a committee of the Eugenics Education Society (London), headed by the president, Leonard Darwin, which has been submitted to Parliament.

As a conclusion to the discussion, which is printed in the January, 1920, *Eugenics Review*, Major Darwin prints the following summary:

"Taxation should fall on parents and on the childless in proportion to their ability to bear the strain. To make the incidence of the income tax just, the amount thus now obtained from the childless should be increased and that from parents decreased, the transfer of wealth thus affected should bear some relationship to the income taxed, and consideration should be given to the distinction between wealth which has been won by the individual taxed and wealth which he has inherited. Smaller incomes being less taxed, to allow the family income to count as several separate incomes would produce the desired differential result, though, in order not to diminish the revenue, the rate per pound would have to be raised in all grades. If such a reform cannot now be fully adopted, the principles involved should, we urge, be authoritatively sanctioned, and when in the future taxation can be lowered, it should first be materially lowered on parents before any burden is taken off the childless. The winning of a moderate income by their own work, the saving and conversion into capital of some of this income, a saving needing care and self-sacrifice, the preservation of this capital in succeeding generations in consequence of thrift, temperance, and perseverance—these have been different steps in the history of the creation of that part of the nation which would be affected by such a reform. Where any of these conditions exist, there the stock must generally be sound, and the nation demands a relatively more rapid multiplication of its soundest stocks."

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[2] *Popular Science Monthly*, April, 1910, pp. 313–331.

Variation of the Palm Weevil

While collecting in the vicinity of Daytona, Fla., April 5 to 9, 1919, I made two visits to a freshly cut cabbage palmetto stump, the sap of which had started to ferment, and captured ninety-two specimens of the palm weevil (*Rhynchophorus cruentus* Fabr.). This large series was taken to show to what extent the species varies both in size and color. The males are readily recognized, regardless of size and color, by the noticeably thicker and roughened beaks or rostra. The following figures show that size and color are in no way sexual characteristics and that those referable to the two larger groups are remarkably uniform in numbers, while those that might be termed strictly intermediate are comparatively few. The entirely black form is known as variety *zimmermanni* Fabr.

TABLE OF COLORS

Entirely black 38 specimens—20 males and 18 females.

Red present to a greater or less extent on the rostrum, thorax, elytra (wing cases), legs and the basal and anal segments of the abdomen, 42 specimens (21 males and 21 females).

Thorax and elytra both slightly marked with red, legs entirely black, 6 specimens (3 males and 3 females).

Thorax only slightly marked with red, rostrum and tibiae reddish, 5 specimens (2 males and 3 females).

Elytra only slightly marked with red, legs black (1 female). Total, 92.

TABLE OF SIZES

Smallest specimens, males and females, 28 mm.

Largest specimens, males and females, 36 mm.

Not exceeding 30 mm., 14 males and 16 females; entirely black, 7 males and 7 females; marked with red, 7 males and 9 females.

Exceeding 30 mm., 32 males and 30 females; entirely black, 13 males and 11 females; marked with red, 19 males and 19 females. Total, 92.

EXPLANATION OF PLATE

First row: 1, 2 and 3 males; 4 and 5 females.

Second row: 1, 2, 3 and 4 males; 5 females.

Third row: 1 and 2 females; 3, 4 and 5 males.

Fourth row: 1 female; 2 male; 3, 4 and 5 females.

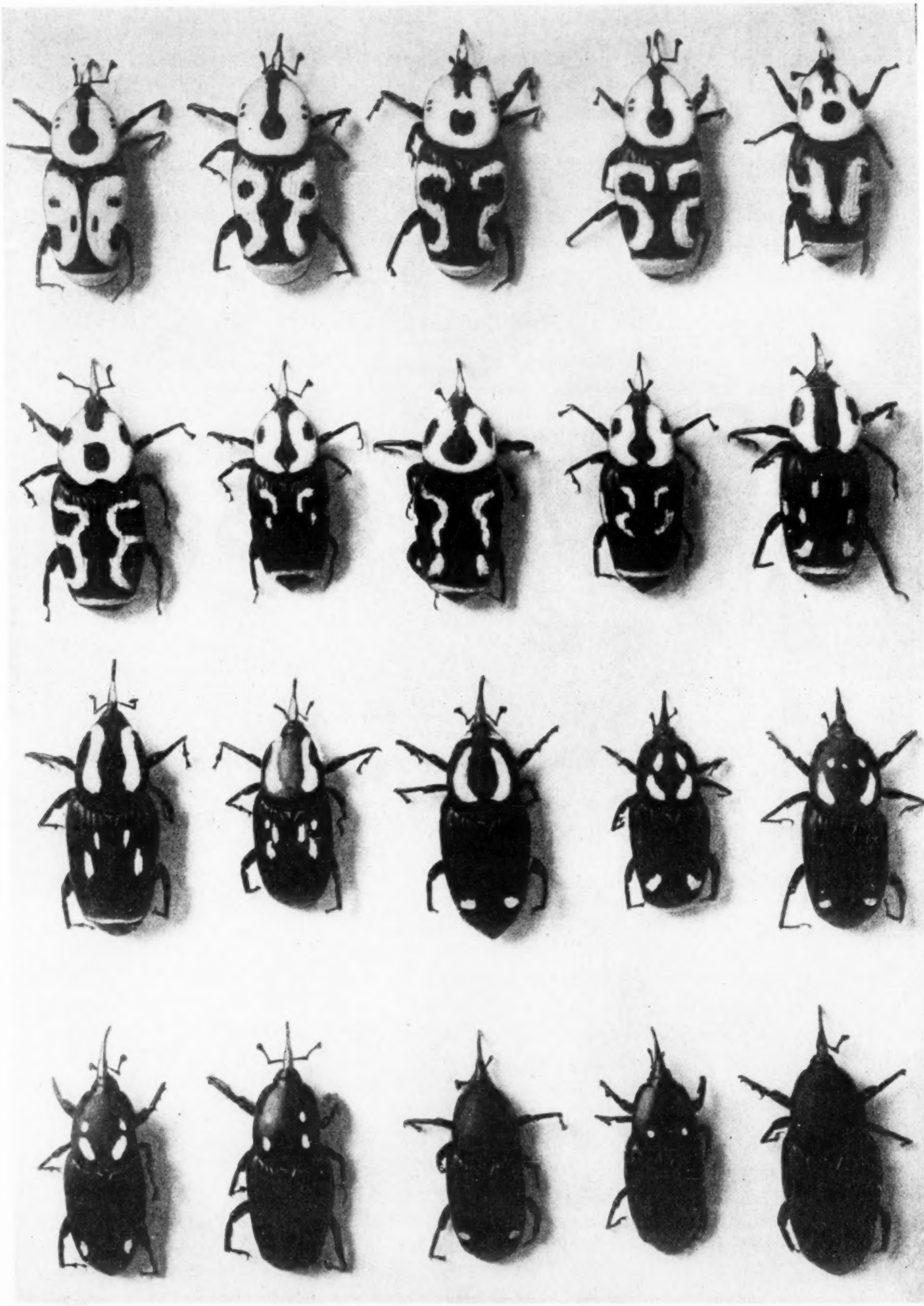
This series shows practically a complete gradation between an almost red specimen (the first in the series) and the pure black specimen at the end of the last row.

Charles W. Johnson.
Boston Society of Natural History,
Boston, Massachusetts.

The Meaning of Continuous Variation in Color

It is rare to find in the animal world an example of perfectly continuous graduation in a color pattern, and all within a single species inhabitating a single locality. What is the meaning of the remarkable series? There seems to be a mystery here. Something for the mutationist and protective coloration experts to pay attention to. Are these beetles, (*Rhynchophorus cruentus*), in the process of acquiring a camouflage or are they losing their red color pattern and becoming all black, like the last of the series? Perhaps the color has nothing to do with survival value, and merely varies through some direct influence of the environment, to which surface pigmentation is usually extremely susceptible. If so, why should they differ so much although living in a presumably uniform environment?

It does not seem that Mendel's laws of heredity find a practical illustration here, since besides these 20 shown in the plate (Fig. 17), the other 72 in Mr. Johnson's collection are quite as impossible to place in any two categories, one



CONTINUOUS VARIATION IN A SINGLE SPECIES

These are specimens of the palm weevil. The color pattern, which is dark red, has been here painted white. Such continuous variation in color is rarely found among insects. Its meaning is discussed on the opposite page. (Fig. 17.)

of which shall be a D and the other an R. It would at least require the postulation of so many determiners that Mendel's laws would fail to have a pragmatic value. Still, the series is not an example of unimodal variation since the most common types are not those of the two middle rows, with "entire black" of rare occurrence. Nearly half of all the specimens are entirely black, 38 out of 92 in Mr. Johnson's figures. It would seem that these beetles may be the result of a cross between a colored variety, similar to the first specimen, with a black variety as seen in the last specimen.—F. A. W.

A Study of Country Children

That children from a good farming district are more intelligent than children from a poor rural district in Indiana is the conclusion of S. L. Pressey and J. B. Thomas, who present their study in the Sept., 1919, issue of the *Journal of Applied Psychology*.

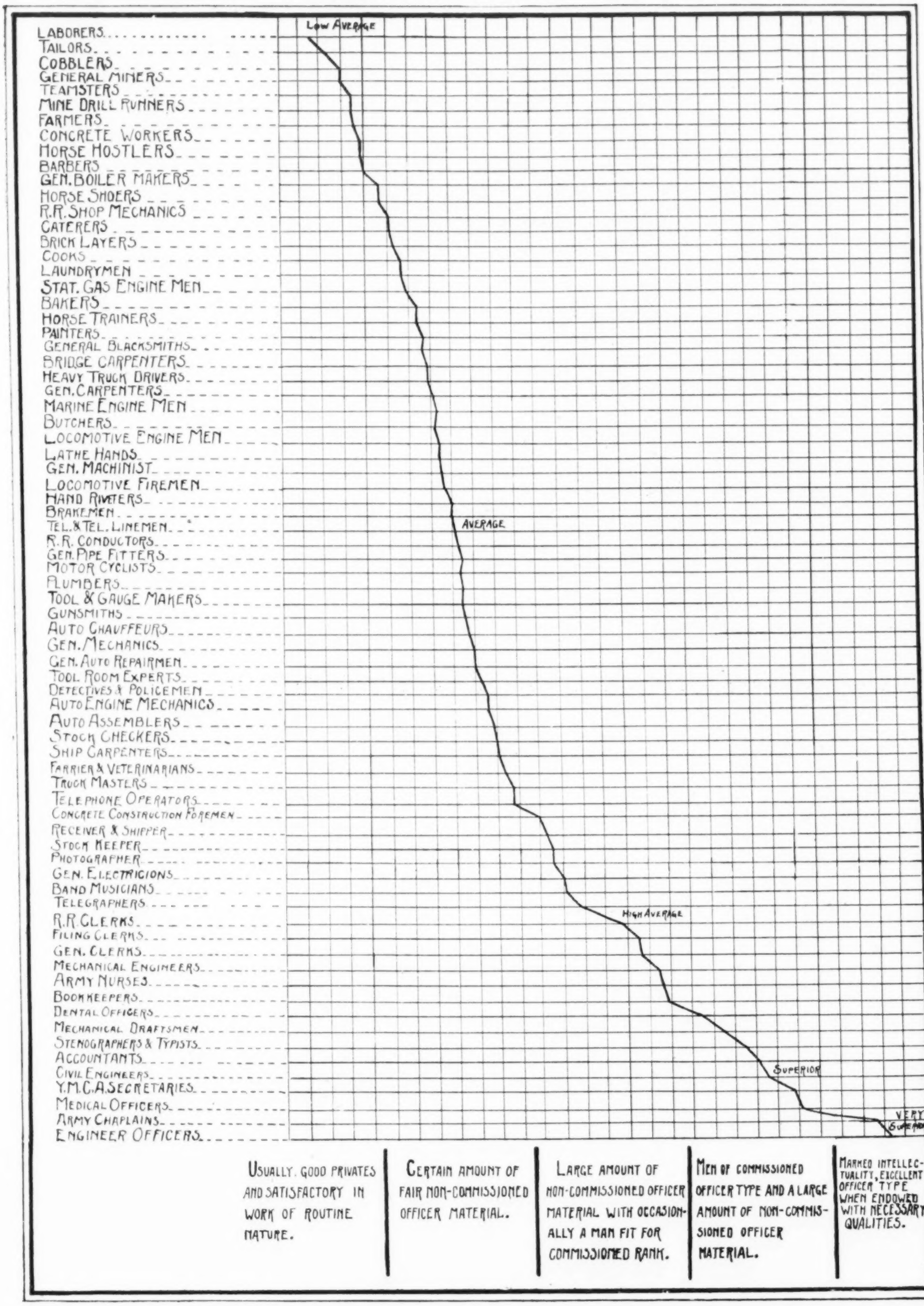
"It is not infrequently asserted," they remark, "that in the country districts a constant selective process is going on, the poorer, less intelligent stock being pushed back more and more into the hill country where the land is poorest, while the more able, assertive elements of the population obtain the best land and the best opportunities. That is, on this assumption, there should, in an agricultural community, be a positive correlation between land values and intelligence."

The assumption is definitely upheld by the results which the writers secured; but they also found that all the country children whether from prosperous or backward districts, averaged below city children in intelligence.

Measuring Intelligence

Next to physical fitness, intelligence is perhaps the most important single factor in a soldier's efficiency. So says a pamphlet entitled "Army Mental Tests," published in November, 1918. Mental tests prepared by a committee of the American Psychological Association and of the National Research Council were given to recruits during the two weeks immediately preceding their entrance into the Army. The ratings which these men earned furnished a fairly reliable index to their ability "to learn, to think quickly and accurately, to analyze a situation, to maintain a state of mental alertness and to comprehend and follow instructions. The score is little influenced by schooling. Some of the highest records have been made by men who had not completed the eighth grade."

The tests were not, however, the full measure of a man's value in the military service, nor did they prove that men of equal mental rating were necessarily of equal military worth. Such qualities as loyalty, bravery, power to command, and the other traits which go to make up a good soldier, could not be measured by this test of intelligence. In the long run, however, those traits are more likely to be found in men of supeior intelligence than in men who are intellectually inferior. That a man's value in the military service could not be judged by a test of intelligence alone has been shown by the fact that many of the men who earned only low mental ratings in the tests made good in actual practice in positions of responsibility. Nevertheless the intelligence rating was found to be one of the most important aids in the selection and assignment of men to the specialized tasks of the Army. The accompanying chart graphically illustrates the occupational intelligence standards based on data for approximately 36,500 men.



MENTAL RATINGS OF 36,500 MEN CLASSIFIED ACCORDING TO OCCUPATIONS

Mental tests were conducted by the Army to aid in the selection, classification and assignment of men to particular tasks requiring rapid adjustment. The tests of course could not tell infallibly what kind of soldier a man would make, but they were very useful in indicating his probable value to the service. (Fig. 18.)

THE DEVELOPMENT OF USEFUL CITIZENSHIP

It Is Not Enough to Maintain the Standard of the Human Race at Its Present Level—Public Opinion Now Recognizes Need of Producing Better Racial Stocks

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IN order to bring about any real and lasting improvement in the quality of a given population, it is necessary to recognize not only the need for cutting off the defective lines of descent, but the positive side of the problem: that of increasing the production of the more worthy strains.

There should be a judicious and necessary diminution of births among those who have the least physically, mentally, morally and economically with which to endow their children. Restrictions should be placed more stringently on those furthest removed from useful citizenship, so that the proportion of the unfit would tend to decrease in each succeeding generation.

The need for cutting off the defective lines is coming to be understood and appreciated. Some practical steps to accomplish the desired result are being taken, which show the trend of public opinion and will lead to further accomplishment in the same direction.

But the cutting off of defective lines alone will only serve to maintain the standard at its present level. Conklin states in his "Heredity and Environment," p. 425, "If only the very worst are eliminated in each generation, the standard of a race is merely maintained." In order to raise the standard it is necessary to greatly increase the birth and survival rates among those above mediocrity who are the useful citizens of today.

The factors which have acted both directly and indirectly to reduce the productivity of our most gifted and prosperous members of society, should be investigated that measures may be directed toward removing the cause.

Some practical influences may be brought to bear, under present social conditions, which will help to bring about a differential fecundity in favor of the better stocks.

Let us consider first, relief of the over-burdened mother with a further development of the creche or day nursery, and a possible extension service into the homes. The responsibilities of the mother might be sufficiently relieved so that no greater effort would be required for the care and up-bringing of three children than she now expends on two. (See Note A.)

In order to convince the well-to-do of their responsibility for the future development of the race, a great educational compaign should be inaugurated. Recognition and the bestowal of honor upon the parents of superior children might tend to augment the birth rate in this group.

HOPE IN THE GREAT MIDDLE CLASS

However, it is neither extreme of the economic ladder which is the hope of the future, but that great mass of useful citizens between these extremes. Rational methods of increasing the fertility of the more worthy strains in the different income groups of this great middle class should be considered.

As the economic aspect has the widest bearing, some form of prize or bonus for the greatest number or the best conditioned children has been among the first measures advocated, but the amount has usually been entirely in-

adequate and the method has been open to the objections raised against all forms of bribery.

Dr. Saleeby, in his, "Method of Race Regeneration," mentions three precautions to be observed in giving financial aid to parents;

"First, the help is not to be a bribe.

"Second, it is to be specific, definitely reaching the point toward which it is aimed, and

"Third, it is to be steady and continuous like the child's needs."

It might be possible to form a Parents' Mutual Protective League in such a manner as to comply with all three of Dr. Saleeby's requirements, with a fourth stipulation added—that the applicants be required to measure up to a certain standard as regards heredity as well as physical, mental and moral development.

If 92 children are born annually per thousand women between 15-45 years, as was the case in 1913 for New York City, we may say roughly that one woman in ten between 15-45 years has a child each year.

Let us suppose that the entire ten families should be willing to pay a small sum annually to form a protective fund so that the annual payment of all ten families would go as a benefit to the one family that was productive that year, to cover the unusual expenses at child-birth and during confinement, as well as smaller sums at stated intervals afterward.

The increased expenses would thus be carried by a group instead of being met wholly by the productive parents concerned.

The benefit payment could not be considered a bribe, or in the light of charity, because the beneficiary would also be one of the contributors.

EXTENSION SERVICE IN THE HOME

It would be specific, reaching the point toward which it was aimed, if administered carefully by the agent of the proposed society, especially if in connection with prenatal work and the follow-up visits of a nurse.

It would be reasonable to expect a reduction in the number of still births and in the loss of life in early infancy from accidents and complications which may thus be avoided. Also maternal mortality should be influenced for the better.

The benefit could be steady and continuous or just to cover the lying-in period as arranged for and desired.

Compliance with the fourth stipulation would give the plan eugenic value as it would open the way to increase the birth and survival rates among those now shaping the thought and controlling the affairs of the nation. It is well known that our captains of industry, statesmen, soldiers, writers, scientific and professional classes are not perpetuating their strains in sufficient numbers to keep their stocks intact.

A recent number of the JOURNAL OF HEREDITY reported an investigation of the California Society of Mayflower Descendants showing the utterly inadequate fecundity among its members.

The somewhat spectacular statement was made that if the present rate of less than two children per family should continue for another three hundred years, it would be possible to put all of the descendants of that rare stock into a boat no larger than the Mayflower without overcrowding. If this reproductive rate can be taken as a criterion of the superior stocks throughout the country, it is none too soon to sound the clarion note to awaken a widespread interest and consideration of what practical steps may be taken along constructive lines to prevent racial decay.

In order to keep a stock from actual decline in numbers, Robert C. Sprague has shown that there must be an average of 3 7/10 children per fertile family to assure the raising of at least three children to marriageable age.

EFFECT OF INCOME ON FAMILY LIFE

The relation between the amount of income and the number of children in a family is definitely known. It is certain that an inverse ratio exists in most

sections of our country today; in a general way statistics show the larger families to be associated with the smaller income groups and vice versa.

It is shown by the 1918 report of the Federal Children's Bureau that the death rate of infants under one year is very closely correlated with the earnings of the father. Where the father receives less than $550 yearly, one baby in six does not reach its first birthday, while only one in sixteen dies before reaching one year where the father earns as much as $1,250. The economic status of the family has a very important bearing upon the number of children surviving in any one group.

The average amount that the family "budget" is increased by the advent and support of each additional child in the income groups between $800 and $2,000 has been determined by the valuable research of Wm. F. Ogburn of the Bureau of Labor Statistics. The equations which he has formulated should prove very helpful in determining the average expenditure for different commodities for families of varying sizes within the stipulated incomes. (See Note B.) Further research may be required to determine similar averages for the higher income groups.

It seems reasonable to suppose that the expenses after the lying-in period for the first child, would not quite return to the amount expended to support the parents alone; and so, with the second, third and subsequent children, the total amount spent should be greater than when the family was one less in number, if the established standard of living is to be maintained.

The dues to form the protective fund would have a certain definite relation to the economic status of the family; the income group receiving from $500 to $1,000 yearly would have a low annual fee to pay; the next group receiving from $1,000 to $1,500 would contribute a slightly larger amount and so on. Or groups may be formed by bodies of people with like interests, such as teachers, college professors, various clubs and societies organized for other purposes, as well as young professional and business men who might adapt this plan to meet their needs and thus enable them to enjoy a protected parenthood among their most worthy members.

It would be possible to develop the plan on broader, more comprehensive lines, if eligibility for membership could be in several classes—associate, active, and supporting.

Associate members would pay an annual fee of $2 and would receive bulletins and other printed matter that was issued.

Active members would pay an annual fee proportionate to income, and would be the only class of members to participate in the benefit.

Conceivably, many who are economically independent and deeply interested in the advancement of the race, might become supporting members contributing $1,000 or more. These could be known as "Founders;" contributors of $500 could be "Patrons," and those paying $100 "Benefactors," etc.

If the income from the above sources permitted, a Foundation for the Promotion of Rational Parenthood could be developed with departments for Research, Education of Public Opinion, and a magazine devoted to such subjects as Eugenics, Child Welfare, Public Health, Sex Education, Voluntary Parenthood etc., all tending directly or indirectly to advance the cause of race betterment.

What more fitting memorial to Roosevelt could be erected as a tribute to his ideals, than an institution of this sort?

In order to safeguard earners against the disquietude caused by a rise in the cost of living, such as that through which we have just been passing, it is advisable to adopt measures, by means of which adjustment of wages to the cost of living is more or less automatic. (See Note C.)

WAR'S DRAIN ON WORTHY STOCKS

The recent war, with the inevitable loss of many choice strains of young manhood, has shown the necessity of constructive effort to increase the fertil-

ity among the remaining worthy strains.

It may and should do much to arouse public opinion to support measures directed toward the building of a sounder, saner, more enlightened race.

Note A

A great step toward the solution of the problems of the care and training of children under school age would be taken, if there could be a development of the creche or day nursery as a department in our public school system, in such a way that young children could be cared for for an hour or for the day.

A training school for trained mothers' assistants could be developed in connection with the creche, with a force of doctors, nurses, kindergartners and child psychologists to instruct in the care and feeding of infants as well as their physical and mental development, by games, exercises, stories etc. The trained mothers' assistant would not be a governess, trained nurse, or kindergartner, but would partake a little of all three, so as to be thoroughly competent to care for healthy children under school age.

It would be an advantage if the course of study could be standardized by the Board of Regents and a diploma awarded. Thus a new and dignified profession for women would be developed.

If this course should be given in an intermediate year between grammar and high school, every girl leaving school would have a legitimate means of earning a livelihood, and the plan would have a far-reaching effect, not only in better care of the babies of this and the next generations, but it might aid in the solution of social problems as well.

Note B

See, "Financial Cost of Rearing a Child" by Wm. F. Ogburn, Bureau of Labor Statistics in the "Report of the Children's Bureau Conferences May and June 1919." Bureau Publication No. 60, p. 26.

Note C

One firm in Central New York has instituted what is called the High Cost of Living Wage Plan after considerable study and investigation. They put the following plan into effect in January 1917 after a liberal raise in wages had already taken place.

They selected Bradstreet's Index Number as a basis for calculations, as that figure formed as it is from the average of 100 commodity values, such as a ton of coal and a bushel of potatoes, corresponds closely to the actual changes in living expenses and does not make sudden, large fluctuations. The increase during the previous year was determined, and a 1 to 20 ratio adopted so that the percentage for the H. C. L. wage would increase or decrease 1% for each 20-point change in the Bradstreet number, or ¼% for each 5-point change; the changes being made monthly and the Index Number for the preceding month being used throughout the month following. The extra wages were given in a separate envelope known as the High Cost of Living Envelope, the regular wages being given as usual in another.

The percentage of extra wages received was 16% in Jan. 1917. From this point it gradually, but steadily rose until it reached 43½ in August, 1918, which was the highest point for 1918. The fluctuations during 1919 have been from 33¾% in April to 48¼% in December.

The index number being determined by a firm entirely outside of the company is a factor to be considered from its psychologic bearing, as the company itself cannot be held responsible for the fluctuations.

Although this plan, in its entirety, may not be adapted to all forms of business, still, it may be of interest to note that in practice it fully equalled anticipation, and its justice is unquestioned.

INHERITANCE, by Whitfield G. Howell. Pp. 190. Boston: The Roxburgh Publishing Co., Inc., 1919.

It is difficult to say anything for Mr. Howell except that most damaging of all compliments, that "he meant well." He has written a novel to convey to the public the supposed truths of heredity. But almost everything he tells about heredity is incorrect. The book has, moreover, little literary merit.

A MUTATING BLACKBERRY-DEWBERRY HYBRID

L. R. DETJEN

N. C. Agricultural Experiment Station, West Raleigh.

MUTATIONS among the blackberries and dewberries, with the exception of chimeras, have been seldom reported. *Rubus laciniatus* Willd. is considered a cut-leaved form of the European blackberry, *R. fructicosus* L. Whether it originated from a seed or from a mutating vegetative bud seems to have never been recorded. A cut-leaved variety of dewberry of distinctly trailing habits has also found its way to the market and is grown mostly for ornamental purposes, but, like *Rubus laciniatus*, the origin of this dewberry is obscure and only a matter for speculation.

It was the writer's good fortune to discover in the summer of 1915 a similarly cut-leaved plant arising as a bud mutation from what appears to be a wild, natural, blackberry-dewberry hybrid. As this hybrid form is very common in the vicinity of Raleigh, N. C., no especial emphasis need be laid on the probable parental species. The plant was found growing on a high embankment on the railroad right-of-way of the spur that enters the State Fair Grounds at West Raleigh, N. C.

The plant when discovered possessed two canes, one normal, *i. e.*, with entire leaflets, and one abnormal, *i. e.*, with finely divided leaflets (see Figs. 19 and 20). As the plant possessed all indications of possible propagation by means of tip-layers, this method was at once resorted to and two new plants were thus secured.

In the late fall of 1915 the mutating crown was taken up and planted in the station experimental vineyard. The two new plants that were secured by means of tip-layering were planted in the horticultural grounds among five varieties of blackberries and three varieties of dewberries. All of the plants grew and reproduced the divided

THE CUT-LEAVED MUTATION

A one-year old cane showing the finely divided leaflets. (Fig. 19.)

A CANE FROM THE ORIGINAL PLANT

This shows well the arched cane. Note also the self-rooted tip-layer and the undivided leaflets. This plant produced the cut-leaved form by means of a mutating vegetative bud. Greatly reduced. (Fig. 20.)

INTERMEDIATE ATAVISTIC TYPE

This constitutes the first visible atavistic step of the cut-leaved form. (Fig. 21.)

EXTREME ATAVISTIC TYPE

The leaflets on this cane are undivided like those on the original wild forms. (Fig. 22.)

leaflets. The two tip-layered plants in succeeding years continued to reproduce themselves naturally by means of suckers and tip-layers, and these also produced the divided leaflets of the original mutation.

In the fall of 1919, two atavistic mutations were observed growing among the progeny of these plants. By careful study and root tracing, these atavistic forms were found associated only with those plants that had originated as suckers from the roots of one of the original tip-layered plants. One of these atavistic mutations affects the four lower leaflets only, these being entire, while the upper leaflet is more or less divided (see Fig. 21). This form might be termed an intermediate type. The other mutation consists of a complete reversion of all the leaflets to the original undivided form. This is the extreme type (se Fig. 22). All of the leaflets on these later atavistic plants are uniform, and none exhibit the tendency toward segmentation.

From a horticultural viewpoint, these mutations are extremely interesting, and the finely divided leaf forms may even be termed ornamental. The canes normally grow arched, ascending about 2 to 3 feet high with short, leafy flower clusters. The foliage on the young canes appears by far the more ornamental because of the beautifully five-pointed and much divided leaflets. On the fruiting canes the leaves are less divided and less graceful, and therefore such canes ought to be removed soon after the flowering season. Fruit on these mutating plants, especially the cut-leaved forms, is very seldom produced, notwithstanding the abundance of pollen that is borne by the nine different varieties of Rubus that grow in close proximity—in fact within the same row.

HEREDITY AND ENVIRONMENT IN THE DEVELOPMENT OF MEN, by Edwin Grant Conklin, professor of biology in Princeton University. Princeton University Press, 1919. Third revised edition, Pp. 361, with 101 illus.

When Dr. Conklin's book first appeared in 1914 it met with a warm welcome, but much progress has been made since then in the study of eugenics, and an examination of this latest revision shows that the book has hardly been brought up to date. The principal changes have been made in the chapter on "The Cellular Basis of Heredity and Development," and Dr. Conklin's authority in this field makes what he has to say on the subject welcome. But the sections devoted to eugenics are inadequate at present, and any serious discussion of the application of eugenics is almost lacking. The book is still disfigured by a number of old illustrations that ought not to be allowed to circulate in the present age of photography, though their offense is more esthetic than scientific.

The inadequacy of Dr. Conklin's treatment of his subject is more or less inevitable, since he writes wholly as a biologist, and the study of heredity and environment of men from a purely biological point of view is fraught with great difficulties. A book on the subject, to have much practical value, must be written largely from the biometric and sociological points of view. The author has perhaps made as much as possible out of the material available, but it will be a long while before the purely biological data available on man are sufficient to satisfy an inquisitive reader. Even of the material available, a more rigid selection should have been used, as in the enumeration of characters in man that are supposed to be inherited in Mendelian fashion.—P. P.

AN AWARD OF HONOR TO WALTER VAN FLEET

For His Contributions to the Advancement of Horticulture, Especially Roses, He Is Given the George Robert White Medal of Honor

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THE presentation of certificates, diplomas and medals by societies as well as by national and international expositions has been a recognized practice for many generations. Usually such trophies are given in lieu of a money premium in recognition of the excellence or the magnitude of an exhibit.

As early as 1871 the American Pomological Society decided to secure a die for a medal to be awarded as its premium in lieu of cash, and this medal has since been awarded to individuals, firms and societies for specimens or collections of fruit exhibited. Such awards tend to stimulate competition among growers for the coveted prize, the excellence of the exhibit being gauged by the character of the metal used (silver or bronze) in striking the medal.

It remained for Mr. George Robert White of Boston to make it possible for the Massachusetts Horticultural Society, through his gift to it in 1909 of $7,500, to award to the man or woman, commercial firm or institution in the United States or in some other country, doing the most in recent years to advance the interests of horticulture in its broadest sense, the medal known as the "George Robert White Medal of Honor." Every year since its foundation it has been given to workers in the field of horticulture, not because they exhibited a plate of fruit or assembled a large and noteworthy collection of varieties, but rather for the contribution which they as individuals have made to the horticultural world.

So far, two well-defined motives have apparently dominated the ideas of the judges charged with awarding the George Robert White Medal of Honor. One evident motive is to encourage and adequately honor productive horticultural exploration; the other is to encourage the production of new plant forms, particularly orna-

THE GEORGE ROBERT WHITE MEDAL OF HONOR (FIG. 23)

mentals, by means of hybridization. No less than five of the ten medals so far awarded have been given in recognition of achievement in the production of new plant products.

The award of the medal in 1919 was made to Dr. Walter Van Fleet of the United States Department of Agriculture, Washington, D. C., "for advance in the hybridization of garden plants, especially of the rose." The name "Van Fleet" is synonymous with meritorious climbing roses of American origin. In the work of producing roses, Dr. Van Fleet has not been satisfied with a plant that produced a flower of the quality, size and color desired; the production was not complete or satisfactory from his point of view unless the plant possessed a high degree of vigor, hardiness, resistance to disease and abundant bloom. In Silver Moon, Dr. W. Van Fleet, American Pillar, Magnafrano, Rugosa Magnifica, Birdie Blye and Bess Lovett these characteristics are strikingly manifested.

But the crowning achievement in the production of roses is yet to be introduced to the American public. This we believe will be accredited to Dr. Van Fleet when his new Multiflora Rugosa is given to rose lovers who find themselves situated in territory where native wild roses once carpeted the earth with a glory of bloom almost beyond comprehension in its beauty and abundance, but where the horticultural varieties of Europe and the eastern United States languish and die. In the great inland empire of the United States, frequently designated the "Great Plains," these new children of the hardy north European rugose promise to live, flourish and once more restore to the prairie the blush of the rose which it wore as a crown of glory each spring before the advent of the plow. These new forms are notable not only for their flowers but because they are, when not in bloom, shrubs of attractive form and foliage.

No contribution of new plant forms to ornamental horticulture has added more than these new creations promise. They are ornamental shrubs with pleasing habit, abundant, glossy, attractive foliage of the rugosa type, and a wealth of bloom followed by large ornamental heps. The production of these rose shrubs is the tangible expression of a cherished horticultural ideal, and demonstrates dominance of mind over matter.

The awarding of the George Robert White Medal of Honor to Dr. Van Fleet is the placing of an honor well deserved. May he live to achieve a more complete fulfillment of his ideals!

The Birth Rate in Mixed Marriages

An increased birth rate in marriages between Jews and Lutheran Germans in Hamburg is described by R. E. May (Ztschft. f. Sexualwissenschaft, April, 1919). Taking several hundred marriages of each class, contracted in Hamburg in 1900, he found the following results in the birth records of 1901 and 1902: Both partners Jewish, 9.0 births per 100 marriages; both partners Lutherans, 11.7; husband Jewish, 14.0; wife Jewish, 19.6.

It is of course questionable whether the numbers involved are large enough to have any real significance in relation to fecundity. Professor May thinks they are and that the explanation is economic, rather than biological, the mixed marriages in his opinion representing cases where money was an important factor, and these households therefore being better able to afford children.